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ABSTRACT

The hearing reported in this document focuses on K-12 and undergraduate science, mathematics, and engineering education and the improvement of the educational system to prepare the 21st century workforce. The report includes statements from Ms. Narvella R. West, Executive Director for Science, Dallas Independent School District; Dr. Geoffrey C. Orsak, Director, The Infinity Project, Southern Methodist University; Dr. Neal J. Smatresk, Dean of Science, University of Texas at Arlington; Dr. Sebetha Jenkins, President, Jarvis Christian College; Mr. Ezra C. Penermon, Manager, Workforce Development, Texas Instruments; Ms. Elissa P. Sterry, Deputy Manager, Public Affairs, ExxonMobil Corporation; and Mr. Norman B. Robbins, Community Relations Manager, Lockheed Martin. (YDS)

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ED 473 141

PREPARING THE 21ST CENTURY WORKFORCE: STRENGTHENING AND IMPROVING K–12 AND UNDERGRADUATE SCIENCE, MATH, AND ENGINEERING EDUCATION

FIELD HEARING

BEFORE THE

SUBCOMMITTEE ON RESEARCH

COMMITTEE ON SCIENCE

HOUSE OF REPRESENTATIVES

ONE HUNDRED SEVENTH CONGRESS

SECOND SESSION

APRIL [illegible], 2002

Serial No. 107–59

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PREPARING A 21ST CENTURY WORKFORCE: STRENGTHENING AND IMPROVING K–12 AND UNDERGRADUATE SCIENCE, MATH, AND ENGINEERING EDUCATION

MONDAY, APRIL 22, 2002

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON RESEARCH,
COMMITTEE ON SCIENCE,
Washington, DC.

The Subcommittee met, pursuant to call, at 2:00 p.m., in the Hamon/Simmons Biomedical Research Building Auditorium of the University of Texas Southwestern Medical School at Dallas at 6000 Harry Hines Boulevard, Dallas Texas, Hon. Nick Smith [Chairman of the Subcommittee] presiding.

Present: Representatives Smith and Johnson.

COMMITTEE ON SCIENCE
SUBCOMMITTEE ON RESEARCH
U.S. HOUSE OF REPRESENTATIVES
WASHINGTON, DC 20515

Hearing on

Preparing a 21st Century Workforce: Strengthening and Improving K-12 and Undergraduate Science, Math, and Engineering Education

Monday, April 22, 2002
2:00 to 4:00 PM
Hamon/Simmons Biomedical Research Building Auditorium
University of Texas Southwestern Medical School at Dallas
Dallas, TX

WITNESS LIST

Ms. Narvella West
Executive Director for Science
Dallas Independent School District

Dr. Geoffrey C. Orsak
Director, The Infinity Project
Southern Methodist University

Dr. Neal Smatresk
Dean of Science
The University of Texas at Arlington

Dr. Sebetha Jenkins
President
Jarvis Christian College

Mr. Ezra C. Penermon
Manager, Workforce Development
Texas Instruments

Ms. Elissa P. Sterry
Deputy Manager, Public Affairs
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Lockheed Martin

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HEARING CHARTER

SUBCOMMITTEE ON RESEARCH
COMMITTEE ON SCIENCE
U.S. HOUSE OF REPRESENTATIVES

Preparing a 21st Century Workforce: Strengthening and Improving K–12 and Undergraduate Science, Math, and Engineering Education

MONDAY, APRIL 22, 2002
2:00 P.M.–4:00 P.M.
HAMON/SIMMONS BIOMEDICAL RESEARCH BUILDING AUDITORIUM
UNIVERSITY OF TEXAS SOUTHWESTERN MEDICAL SCHOOL AT DALLAS
6000 HARRY HINES BOULEVARD
DALLAS, TX

1. Purpose

On Monday, April 22, 2002, the Subcommittee on Research will hold a field hearing in Dallas, Texas on K–12 and undergraduate science, technology, engineering, and mathematics (STEM) education. The hearing will:

- Examine challenges for improving K–12 and undergraduate STEM education.
- Review examples of NSF-sponsored programs, and locally developed programs, to improve K–12 and undergraduate STEM education and to increase participation by students from diverse backgrounds in these fields of study.
- Explore educational programs that could be developed or expanded to fill current gaps and stimulate STEM education reform.
- Discuss industry needs for a diverse and scientifically literate workforce for the 21st century.

2. Background

Preparation of students at the high school level

The Dallas Independent School District (DISD) is a participant in the National Science Foundation's (NSF) Urban Systemic Initiative (USI) program. The USI program targets the 25 U.S. cities with the largest numbers of school-age children living in poverty and provides grants to undertake a self-study of K–12 systems and develop and implement plans for system-wide reform. The USI initiative aims to improve learning in mathematics and sciences and prepare students of all backgrounds in college-preparatory science and mathematics. The hearing will address specific problems encountered by DISD in training a scientifically literate workforce and in encouraging students to pursue undergraduate majors in science, engineering, and mathematics.

The hearing will also discuss how federal programs such as NSF's USI program have helped K–12 education in Dallas and how future federal assistance can be channeled in the most effective manner.

The Infinity Project, developed at the School of Engineering at Southern Methodist University, offers innovative curricular content to encourage engineering education at the high school level.

Few opportunities exist at the K–12 level for students to explore the fields of engineering, and this deters students from pursuing engineering in college and their careers and the Project seeks to address this gap. The Infinity Project curriculum focuses on the fundamentals of the communications and information age. Examples are drawn from multimedia technology popular in today's culture. In addition to the detailed content, the curriculum demonstrates how modern engineers use math, science, and ingenuity to design and build new technologies.

The hearing will review the progress to date in developing and implementing the Infinity Project, as well as its future prospects. During the 2000–2001 school year,

it was piloted at 14 schools in Texas and recently received approval for use in classrooms across the State of Texas as a math or science elective.

Undergraduate Education

The University of Texas at Arlington (UTA) is an active participant in a number of NSF educational programs on both a local and state level. UTA was a regional leader in NSF's "Shaping the Future" program, which sought to address how investments made by individuals, organizations, and agencies could improve undergraduate STEM education. UTA also conducts site visits throughout the State of Texas on behalf of NSF's USI program and is working with NSF's Math and Science Partnerships in North Texas. Additionally, UTA hosts a number of individual participants in NSF's Research Experiences for Undergraduates (REU) program and receives substantial NSF support for individual principal investigators.

The hearing will address from the perspective of UTA both the successes of NSF's educational programs, as well as how these programs can be improved.

Addressing under-represented populations in science, mathematics and engineering

Minority-serving institutions play a critical role in producing scientists and engineers of diverse backgrounds. According to the United Negro College Fund, Historically Black Colleges and Universities (HBCUs) have graduated and continue to graduate the majority of African American scientists and mathematicians at the baccalaureate level. From 1985–1995, HBCUs graduated 39.5 percent of all African American scientists and 48.1 percent of mathematicians. The goal of increasing the numbers of minorities who pursue careers in mathematics, science, and engineering is tightly linked to effective STEM education programs at minority-serving institutions.

Jarvis Christian College is a private, coeducational, historically African-American institution located in the east Texas town of Hawkins. The hearing will review the accomplishments, as well as address the challenges, faced by HBCUs in North Texas in increasing the number of minorities in STEM fields.

Workforce Challenges

Institutions across the United States are facing a number of challenges in recruiting and retaining ample numbers of highly qualified students to majors in science, mathematics, and engineering. The diverse economy of North Texas is vibrant and increasingly dependent upon technology. Since a shortage of trained scientists and engineers exists for many of these businesses, companies are becoming increasingly dependent upon the importation of foreign scientists through the government's H–1B visa program.

However, the importation of foreign scientists has become more problematic as a number of the industries that need these scientists also require security clearances. The recent award of the Joint Strike Fighter contract to Lockheed Martin of Fort Worth, Texas, is expected to create more than 2,500 jobs in North Texas, the majority of which will be in engineering and other technical sectors. With a project as sensitive to national security as the Joint Strike Fighter, one must question where the engineers and scientists necessary for the project will come from if H–1B visa workers are ineligible.

Texas Instruments (TI) is the world leader in digital signal processing and analog technologies, the semiconductor engines of the Internet age. The semiconductor industry continues to struggle for qualified technical talent in the areas of engineering and technical personnel. TI is no stranger to this difficulty and is deploying several initiatives to help increase the pool of technical talent to fill the jobs of today and tomorrow. TI has worked to put in place various Career Awareness, Scholarship, and Co-operative Work/Study programs with numerous secondary and post-secondary educational institutions to aid in exposing, attracting, and equipping students for the high tech field of micro-electronics. TI is a driving force in statewide programs like the Texas Engineering and Technical Consortium and participates with national industry associations like the Semiconductor Industry Association, the Maricopa Advanced Technical Education Center, and the Semiconductor Research Corporation to fuel efforts to develop a workforce capable of keeping America technically competent.

ExxonMobil is the world's largest publicly traded petroleum and petrochemical company with operations in nearly 200 countries and territories on six continents. Their work is highly technical with many projects that progress over long periods of time. Each year ExxonMobil hires over 1,000 engineers, geoscientists, computer scientists and business majors from more than 100 universities in the United States. To increase the supply of qualified students, the company makes significant contributions to numerous universities and sponsors scholarships, fellowships, internships, and co-op assignments for talented students pursuing engineering and

science degrees. ExxonMobil also emphasizes improving education programs in science, technology, engineering and mathematics, particularly among groups that have been under-represented in these disciplines. Contributions are provided for a full range of educational initiatives from kindergarten through graduate school.

The hearing will address how local corporations perceive the shortage of trained scientists and engineers and what measures they are taking to meet this challenge, including collaborative activities with and assistance to K–12 schools and institutions of higher education.

3. Witnesses

The following witnesses will address the Subcommittee:

- Ms. Narvella West, Executive Director for Science, Dallas Independent School District

  Ms. West will discuss the district's preparation of students at the secondary level to pursue careers in math, science, and engineering. She will expand upon the successes and challenges encountered in specific programs in DISD as well as how federal initiatives to encourage STEM education can be improved. The Subcommittee is particularly interested in DISD's participation in National Science Foundation initiatives, such as the Urban Systemic Initiative (USI), and how it is helping to improve the quality of math and science instruction at the K–12 level.

- Dr. Geoffrey Orsak, Director, The Infinity Project and Associate Dean, School of Engineering, Southern Methodist University

  Dr. Orsak will discuss the development and initiation of the Infinity Project as well as illuminate the role the program has played in bringing exciting and innovative engineering teaching methods to the classroom. The Subcommittee is interested in hearing about the success of the Infinity Project as a public/private partnership in encouraging students of all backgrounds to pursue careers in engineering. Dr. Orsak may also comment on H.R. 3130, the Technology Talent Act of 2001.

- Dr. Neal Smatresk, Dean of Science, University of Texas at Arlington

  Dr. Smatresk will discuss the challenges faced by undergraduate institutions in educating the scientists and engineers of tomorrow. The witness will comment on the efficacy of federal STEM programs targeted at the undergraduate level as well as UT–Arlington's participation in such programs. Additionally, the Subcommittee is interested in the University of Texas at Arlington's local and statewide outreach efforts in conjunction with the National Science Foundation. In his capacity as a professor and Dean of Science at UT–Arlington, Dr. Smatresk will comment on H.R. 3130, the Technology Talent Act of 2001.

- Dr. Sebetha Jenkins, President, Jarvis Christian College

  Dr. Jenkins will discuss the role of Historically Black Colleges and Universities (HBCUs) in contributing to the diversity of our nation's scientists, mathematicians, and engineers. Dr. Jenkins is the Chair of the Institutional and Individual Members of the United Negro College Fund (UNCF) and will comment on how HBCUs benefit from National Science Foundation programs and how these programs can be improved. Additionally, Dr. Jenkins will comment on H.R. 3130, the Technology Talent Act of 2001.

- Mr. Ezra Penermon, Manager, Workforce Development, Texas Instruments

  Mr. Penermon will discuss the future workforce needs for scientists and engineers in the semiconductor industry in general and Texas Instruments in particular. The witness will comment on the diversity and quality of scientists, engineers, and mathematicians entering the workforce. The Subcommittee is also interested in learning about Texas Instruments' local, state, and national initiatives to increase the pool of technical talent to fill the jobs of today and tomorrow.

- Ms. Elissa Sterry, Deputy Manager of Public Affairs, ExxonMobil

  Ms. Sterry will discuss the future workforce needs for scientists and engineers in the petroleum industry in general and ExxonMobil in particular. The witness will comment on the diversity and quality of scientists, engineers, and mathematicians entering the workforce. The Subcommittee is also interested in learning about ExxonMobil's local, state, and national initiatives to increase the pool of technical talent to fill the jobs of today and tomorrow.

- **Mr. Norman Robbins, Community Relations Manager, Lockheed Martin**

  Mr. Robbins will discuss the future workforce needs for scientists and engineers in the defense and aerospace industries in general and Lockhead Martin in particular. The witness will comment on the diversity and quality of scientists, engineers, and mathematicians entering the workforce. The Subcommittee is also interested in learning about Lockhead Martin's local, state, and national initiatives to increase the pool of technical talent to fill the jobs of today and tomorrow.

Ms. JOHNSON. Good afternoon. We are delighted that you are here. I want to welcome my colleague, my boss in this Committee, until next time when the Democrats have the majority, then we can switch roles.

I want to welcome Representative Smith from Michigan, and turn it over to him, for he's presiding.

Mr. SMITH. Well, all of you that know Eddie Bernice Johnson knows that she probably doesn't have very many bosses, certainly not me.

Well, officially the Subcommittee—Science Subcommittee on Research, will come to order. This is an official field hearing of our Science Committee, and certainly I would like to repeat our Vice Chairman, our Ranking Members, welcome to the Committee.

This is the first of two field hearings the House Science Subcommittee on Research will be holding. On May 6th, we'll be holding a hearing in Michigan on first responders. Our Committee also has oversight of the National Fire Administration, what do we do in terms of federal help for first responders, firefighters and the medics, in terms of dealing with local fires and emergencies as well as the potential for being prepared for any terrorist attack.

Today, we meet to discuss the improvements of elementary through undergraduate math and science education and how the federal government, in particular the National Science Foundation, can assist in these efforts.

For some time now, we have recognized the need to improve education in America, especially math and science. How to best go about it, however, has been a more difficult undertaking to resolve. One thing is clear though, and if we want to maintain our competitive edge in the world, we have to do a better job of preparing our students for careers in science, mathematics, engineering, and technology.

Think for just a moment about the war situation that we are in today: engineering students will be designing tomorrow's military planes and smart bombs, and if we don't continue to give a priority to basic research then we don't have the tools or the students that can do that kind of research to keep America very strong militarily, as well as economically. We must improve our science and math education programs os that we can meet these challenges, and it's critical to our economic security, as I mentioned, and it's critical to our national security.

We know that much of the math and science education problems we are facing take root in the early years of a student's life, and certainly if we don't continue to build that enthusiasm and interest through the K–12 school system then we are going to put that student and our efforts to encourage math and science at a disadvantage. The Science Committee, and this Subcommittee in particular, has worked extensively at improving K–12 math and science. Last year, the House passed a bill, we go by numbers, it was H.R. 1858, a bill authorizing the National Science Foundation to build partnerships for improved cooperation between high schools and universities so that students are better prepared for college math and science curriculum. This legislation has received funding components of the President, and it does give a high priority to education, especially math and science.

Consistent with those initiatives, we are now examining how we can improve undergraduate math and science education. To do this, we must first determine exactly where the problems lie. Today's hearing is intended to do just that, as well as consider potential solutions to these problems so that we can work toward legislation to improve education in math and science from the beginning until the completion in college.

We have a diverse panel of witnesses before us today representing high schools, universities, and the private sector. They will discussing some examples of unique programs that Texas has undertaken in education reform efforts, as well as reviewing their experiences with the National Science Foundation-sponsored programs. I anticipate that each will provide their unique viewpoint and experience into the challenges of math and science education, and I expect a productive discussion. I want to thank very much the panelists for appearing before us today, and I look forward to your testimony.

And, with that, I turn the microphone over to our Vice Chairman, our Ranking Member, Eddie Bernice Johnson.

[The statement of Mr. Smith follows:]

PREPARED STATEMENT OF CHAIRMAN NICK SMITH

I would like to welcome everyone to Dallas this afternoon for first of two field hearings the House Science Subcommittee on Research will be holding this year. Today we meet to discuss the improvement of undergraduate math and science education and how the Federal Government, in particular the National Science Foundation, can assist in these efforts.

For some time now, we have recognized the need to improve education in America. How to best go about doing it, however, has been a more difficult undertaking to resolve. One thing is clear though if we want to maintain our competitive edge in the world, we have to do a better job of preparing our students for careers in science, mathematics, engineering, and technology. Think for just a moment about the war situation we are now in: today's engineering students will be designing tomorrow's military planes and smart bombs; today's biology students will be sequencing biological weapons and generating vaccines for them; and today's computer science students will be securing our computer and networking infrastructure against cyberattacks. We must improve our science and math education programs so that we can meet these challenges. It is critical to our economic security, and it is critical to our national security.

We know that much of the math and science education problems we are facing take root within a K–12 school system that is woefully ineffective at preparing students to pursue math and science majors. The Science Committee, and this Subcommittee in particular, has worked extensively at improving K–12 math and science. Last year, the House passed H.R. 1858, a bill authorizing NSF to build partnerships for improved cooperation between high schools and universities so that students are better prepared for college math and science curriculum. This legislation has received funding as a component of the President's significant education reform initiatives.

Consistent with those initiatives, we are now examining how we can improve undergraduate math and science education. To do this, we must first determine exactly where the problems lie. Today's hearing is intended to do just that, as well as consider potential solutions to these problems so that we can work toward legislation to improve undergraduate math and science education.

We have a diverse panel of witnesses before us today representing high schools, universities, and the private sector. They will be discussing some examples of unique programs Texas has undertaken in education reform efforts, as well as reviewing their experiences with NSF-sponsored programs. I anticipate that each will provide a unique viewpoint into the challenges in math and science education, and I expect a productive discussion. I want to thank the panelists for appearing before us today, and I look forward to your testimony.

Ms. JOHNSON. Thank you very much, Mr. Chairman.

Let me sincerely thank you for coming here to Dallas for this field hearing, and I'd like to thank the University of Texas, Southwestern Medical Center, and Dallas for hosting this field hearing. I'm pleased to see such an interest on this topic among the citizens of Texas.

Today's hearing will explore some of the challenges we face in ensuring that the Nation develop a well prepared workforce for the 21st Century. I think most of us would agree that a major component of the challenge revolves around improving K–16 science education.

We are fortunate to have before us a range of witnesses who will describe several government-sponsored and private sector initiatives and partnerships that are contributing to increasing talent and student interest in science and technology careers and improving instruction in these fields.

Chairman Smith and I are working together to bring the Technology Talent Act to a markup in the Research Subcommittee this week. The bill has the basic goal of increasing the number of students who pursue undergraduate degrees in science and technology fields. The Chairman and I are developing an amendment to the bill, which will maintain its basic goal, while also seeking ways to improve the overall quality of undergraduate science education. The testimony we receive today will aid us in perfecting this legislation.

One purpose of today's hearing is to review the implement by the Dallas school system of the National Science Foundation-supported Urban Systemic Initiative program, and we are interested in what has worked and where the barriers are, so that we can talk about constructive changes.

We also realize that educational reform is a community effort, and we have asked representatives from several companies with a major presence in Dallas to tell us some of the ways they are working with the school system here and with universities. Such partnerships provide essential resources and bring heightened visibility to educational reform efforts and to recruiting students to science and technology careers.

I want to acknowledge the support that I received from industry, especially Texas Instruments, for legislation that I initiated that is now incorporated in the National Mathematics and Science Partnership Act, H.R. 1858, which passed the House last July. This legislation creates partnerships between the schools and local businesses to improve classroom instruction in science and math, coupled with college scholarships and industry internships.

I want to thank all of the witnesses who have taken the time to appear before us, to share their views and tell us of the efforts that need to be made for improvement.

And, again, I want to thank Chairman Smith, and, Mr. Smith, I'd like to ask for unanimous consent to file my entire statement for the record.

Thank you.

[The statement of Ms. Johnson follows:]

PREPARED STATEMENT OF REPRESENTATIVE EDDIE BERNICE JOHNSON

Mr. Chairman, I want to welcome everyone to this Research Subcommittee hearing and thank you for convening it here in Dallas. I would like to thank the University of Texas Southwestern Medical Center at Dallas for hosting this field hearing, and I am pleased to see such an interest in this topic amongst the citizens of North Texas.

Today's hearing will explore some of the challenges we face in ensuring that the Nation develops a well prepared workforce for the 21st century. I think most of us would agree that a major component of the challenge revolves around improving K–16 science education. We are fortunate to have before us a range of witnesses who will describe several government-sponsored and private sector initiatives and partnerships that are contributing to increasing student interest in science and technology careers and in improving instruction in these fields. These efforts help move us toward the goal of producing the skilled workers the economy needs for the future.

Chairman Smith and I are working together to bring the Technology Talent Act to a markup in the Research Subcommittee this week. The bill has the basic goal of increasing the number of students who pursue undergraduate degrees in science and technology fields. The Chairman and I are developing an amendment to the bill, which will maintain its basic goal, while also seeking ways to improve the overall quality of undergraduate science education. The testimony we receive today will aid us in perfecting this legislation.

What then are the challenges to achieving an adequate supply of skilled workers from a range of backgrounds for the future?

First of all, growth in the size of the pool of technical talent in the United States—that is, new scientists and engineers—is declining, and it trails the growth levels of many of our foreign competitors. The Department of Labor projects that new jobs requiring science, engineering and technical training will increase by 51 percent between 1998 and 2008—roughly four times higher than average job growth nationally. The skills represented by the individuals who we will need to fill these jobs provide the essential underpinning for the country's ability to shift more of its economic activity into higher technology and more productive activities that support higher wages.

The recent trends in production of Bachelor's degrees in science and engineering are not particularly hopeful for meeting future needs. Between 1986 and 1998, the number of Bachelor's degrees awarded by American colleges and universities in the physical sciences dropped by 11 percent; in engineering by 21 percent; in mathematics by 28 percent, and most surprisingly, in computer and information sciences by 36 percent. The one bright spot is in the biological and life sciences, where the number of bachelor's graduates increased by 71 percent during this period.

One reason that the pool of scientists and engineers is growing so slowly is simply that the group traditionally most likely to enter these fields, white males, is declining as a percentage of new workers. At present, white males constitute a little over 40 percent of the workforce and nearly 70 percent of scientists and engineers. In contrast, white females are about 35 percent of the workforce and only 15 percent of scientists and engineers. The corresponding figures for African Americans and Hispanics are each about 10 percent of the workforce and only 2 percent of scientists and engineers.

Clearly, we must do a better job of attracting women and minorities to science and preparing them to pursue post-secondary studies in science, math and engineering.

The changing economy will not only require more scientists and engineers, but will require most workers to have increased skills. Sixty percent of all new jobs will require at least a high school education; only 12 percent of new jobs will be filled by those with less than a high school education, and the number of such jobs will continue to decline.

These trends suggest the need to improve K–12 science and math education, both to prepare more students to pursue science and engineering studies in college and to raise the skill levels for all students, who will find themselves in a workplace increasingly dependent on technology. Technology now infuses more and more aspects of daily life. Consequently, all citizens need a basic grounding in science, math and technology to function in an increasingly complex world and to lead fulfilling lives.

One purpose of today's hearing is to review the implementation by the Dallas school system of the National Science Foundation-supported Urban Systemic Initiative program. We are interested in what has worked and where the barriers are to making constructive changes. And we hope to learn what you see as the major ac-

complishments of education reform efforts to date and how you go about measuring progress.

We also realize that educational reform is a community effort, and we have asked representatives from several companies with a major presence in Dallas to tell us some of the ways they are working with the school system here and with universities. Such partnerships provide essential resources and bring heightened visibility to educational reform efforts and to recruiting students to science and technology careers. Again we hope to learn more about the nature of these interactions, and particularly, the factors that lead to the most productive and effective kinds of collaborations.

I want to acknowledge the support I have received from industry, especially from Texas Instruments, for legislation I initiated that is now incorporated in the National Mathematics and Science Partnerships Act, H.R. 1858, which passed the House last July. This legislation creates partnerships between the schools and local businesses to improve classroom instruction in science and math, coupled with college scholarships and industry internships. It seeks to identify and attract promising students to careers in scientific and engineering fields of importance to industry. And it focuses particularly on school systems with large numbers of minority students, who are currently under-represented in science and engineering careers.

The goal of heightening the achievement of all students in science and math is particularly important. The Nation must take advantage of the human resource potential of all our people if we are to compete successfully with our major economic competitors in the 21st century. This will require that reform efforts in science and math education seek to engage and cultivate the interest of all children.

I want to thank all of the witnesses who have taken the time to appear before the Research Subcommittee this afternoon to share your views and tell us of your efforts to improve science and math education. I also want to thank Chairman Smith once again for holding this hearing in Dallas, and I look forward to our discussion.

Mr. SMITH. Without objections, so ordered.

I would like to introduce briefly our panelists today, but, Congresswoman Johnson, thank you for organizing this hearing because it is so important to where we go for our future.

The panelists are Ms. Narvella West, Executive Director of Science for the Dallas Independent School District, my Geoffrey Orsak, Director of the Infinity Project of Southern Methodist University, Doctor Neal Smatresk, Dean of Science at the University of Texas in Arlington, Doctor Sebetha Jenkins, President of the Jarvis Christian College in Hawkins, Texas, testifying on behalf of the United Negro College Fund, Mr. Ezra Penermon, Manager of the Workforce Development for Texas Instruments, and Ms. Elissa Sterry, the Deputy Manager of Public Affairs for ExxonMobil, and Mr. Normal Robbins, Community Relations Manager at Lockheed Martin.

Thank you all for appearing today, and as our panelists may know your spoken testimony is limited to five minutes, after which the Members of the Committee will have five minutes each to ask questions, and then we will do a second round, or a third round if necessary. Your total statement will be printed in the record of this committee hearing and provided, not only to the Members of this Subcommittee, but made available to the members of the Full Science Committee, and with that we will start with you, Ms. West, for your testimony.

And, let me say that Natalie Palmer over here, Natalie, we don't have a timer, in Washington we have a red light that starts blinking on and off, but Natalie will be our red light today, and, Natalie, with 30 seconds to go if you'd stand up and hold your blue sheet up or something.

With that, Ms. West.

STATEMENT OF NARVELLA R. WEST, EXECUTIVE DIRECTOR FOR SCIENCE FOR DALLAS PUBLIC SCHOOLS

Ms. WEST. Thank you, Chairman Smith, and Co-Chairperson Congressman Johnson.

The Dallas Independent School District has entered the eighth year in pursuit of systemic reform in science, mathematics and technology education. The District has learned that there is no "quick fix" to removing the barriers to systemic reform. With a focus on "beginning with the end in mind," implementation plans are in place to correct these deficiencies. However, with a student population of approximately 164,000 there is still a diverse set of needs that constantly challenge the mission statement of the Dallas Science Department, and that is, "All students will achieve scientific literacy and proficiency through inquiry-based hands-on, minds-on science instruction."

We have many challenges, many of them include, but are not limited to, the mind set of the entire school community embrace science, mathematics and technology as important for the safety and security of our Nation. Although many studies have been made on the status of math, science and technology deficiencies in America, we still have not made the aggressive strides necessary to reach systemic reform in the Dallas ISD, and we are committed to reaching the District's mission statement, "To prepare all students to graduate with the skills to become productive and responsible citizens."

Accountability for science education has been lacking. We have been historically focused on the courses that have been tested, mathematics, science and reading, at the elementary level. while there are national and state standards for all core subjects, science at the elementary level is not taught consistently across the District. Schedules must be revised to ensure science is taught on a daily basis at all grade levels. We feel that the skills of students must be aggressive as they acquire knowledge in a conceptual manner, to include reasoning techniques, application of learning across disciplines, ability to make evaluations, and competence in the use of information technology as a way of life. We know that hands-on, minds-on inquired-based science is the way to go and the norm for K–12 science. Vacancies, teacher shortages and teacher retention are issues that continue to plague the stability of our schools. Qualified and certified science, math and technology teachers continue to be difficult to hire.

Inadequate laboratory facilities affect successful science instruction.

Our infrastructure is inadequate to meet technological needs of classrooms.

Professional development must go beyond the "sit and get," we must engage our teachers in deep training, content training, in a conceptual manner. Distance learning must be accelerated to reach more teachers in critical teaching areas.

State-of-the-art training facilities are vital for successful professional development. We need training that must mirror the actual teaching areas that shift from the traditional classroom to embrace information, technology and successful pedagogical practices.

Prospective teachers graduate from colleges and universities with very little knowledge of how to teach our urban students.

Assessment practices and bench marking that have been focused on reading, writing and mathematics, must now include science.

We have many different and varied ways that we have addressed many of these challenges. We have the Urban System Initiative, the Urban System Program, which we are now under. The Dallas Independent School District Environmental Education Center is a unique 500-acre campus that provides daily experiences in the form of one to two-hour TEKS/TAKS based programs taught by certified teachers, as well as naturalists. We have Texas Instruments that provides support and state-of-the-art training and financial support for advanced placement courses.

We have the STARS program, which stands for Science Teachers Access to Resources at Southwestern Medical School, which is very unique to Dallas, and it provides training, institutes for both teachers and students. We have the Master of Arts and Interdisciplinary Science program, which is a collaborative master's degree program with Dallas and UT Arlington.

Baylor College of Dentistry provides both summer and year-round programs that target our inner-city students. The City of Dallas offers content rich opportunities for students and teachers to participate in a variety of science experiences through informal science institutions and partners with the DISD. The District's K–8 Mathematics, Science and Technology Fair provides opportunities to participate in a district-wide competition for elementary and middle school students. We also have many other types of competitions that students are very successful in.

Partnerships and collaborations require additional attention and awareness for greater participation. Training and employment opportunities that guarantee jobs in the business community would offer an incentive for participation. Connections with persons who are committed to building a qualified workforce would serve to assist students in making informed decisions about life and their role in society.

At all levels, we need to increase the awareness of programs for both parents and educators.

All students need to have a solid education in science, mathematics and technology to be able to make informed decisions in a society that changes on a daily basis. Adults must embrace the need to accelerate literacy in science, mathematics and technology for the safety and security of America and the Universe.

Mr. SMITH. Ms. West, if you could sort of wind up.

Ms. WEST. The Dallas Independent School District has earned public trust in the Dallas community on a State and National level with Doctor Mike Moses as our General Superintendent. The stability of his leadership has brought a welcomed change toward a renewed focus for the education for all students. Among the accomplishments that we are proud of include: improvements on assessments; passage of a large bond program, and we have developed a state-of-the-art staff development training; and we have clear guidelines as to what we all need to do to make our students successful.

Thank you.

[The statement of Ms. West follows:]

PREPARED STATEMENT OF NARVELLA R. WEST

Abstract

The paper describes some of the major concerns and limiting factors that have caused a slow progression toward systemic reform in the Dallas Independent School District. Problems have been evaluated and there is a clear understanding of the "next steps" toward improving K–12 undergraduate science, mathematics and engineering education. Accomplishments have been highlighted and corrective measures listed in terms of meeting the District's goals and objectives toward systemic reform. Although barriers consistent with other large urban school districts persist, clear guidelines and public support are in place to accelerate the desired outcomes.

Overview

The Dallas Independent School District has entered the eighth year in pursuit of systemic reform in science, mathematics and technology education. The District has learned that there is no "quick fix" to removing the barriers to systemic reform. Data indicates that although test scores are continuing to rise, many of our students are still scoring below the District's expectations on science and mathematics assessments. We are also working to improve technology competence for both teachers and students because proficiency in the area of technology is a critical requirement for today's workforce and/or entry into higher education. With a focus on *"beginning with the end in mind,"* implementation plans are in place to correct these deficiencies. Policy changes will address K–12 science, mathematics, and technology instruction for implementation during the 2002–2003 school year. Systemic reform continues to be our goal as we seek Science, Math and Engineering (SMET) literacy for all students.

Science education in the Dallas Independent School District is faced with the same obstacles as other large urban school districts. Teacher shortages, certification issues, improving retention rates, and attracting qualified teachers are a few areas of concern. For the past eight years DallasISD has been fortunate to have the support of the National Science Foundation to guide our reform efforts. The District is currently in the third year of a five- (5) year $11.6 million dollar cooperative agreement. The National Science Foundation (NSF), through the Urban Systemic Initiative/Urban Systemic Program, has been instrumental in providing funding for training on standards-based programs and teaching methodologies for K–12 science and mathematics teachers. However, with a student population of approximately 164,000, there is still a diverse set of needs that constantly challenge the mission of the District's Science Department, *"All students will achieve scientific literacy and proficiency through inquiry-based hands-on, minds-on science instruction."*

In 1997, the State Board of Education approved the Texas Essential Knowledge and Skills (TEKS) for implementation. The TEKS, which have the recognition of being an exemplary model for State curricula, are aligned with the National Science Standards. The District completed the first alignment between its science curricula and the TEKS for implementation September 1, 1998. Revisions were made summer 2000 to include a K–6 Full Option Science System (FOSS) curriculum. The District's revised curriculum, which is based upon the Texas Essential Knowledge and Skills (TEKS) and Texas Assessment of Knowledge and Skills (TAKS) objectives as well as the infusion of standards-based programs and practices, serve as an exemplary model for curriculum design.

Challenges for Improving K–12 and Undergraduate Science Education

The challenges for improving science education in the Dallas Independent School District include the following:

- The mindset of the entire school community must embrace science, mathematics and technology as important for the safety and security of our nation. Although many studies have been made on the status of science, mathematics and technology deficiencies in the America, we have not made the aggressive strides necessary to reach systemic reform in the Dallas Independent School District. This must change immediately to reverse the shortages of qualified scientists and engineers in a century that relies so heavily on technology. We must ensure that our students have a successful entry into the workforce and higher education. To that end, we are committed to the District's Mission Statement: *to prepare all students to graduate with the skills to become productive and responsible citizens.*

- Accountability for science education has been lacking. We have been historically focused on the courses that have been tested (mathematics, reading and writing) at the elementary level. While there are national and state standards for all core subjects, science at the elementary level is not taught consistently across the district. Schedules must be revised to ensure that science is taught on a daily basis at all grade levels. The upcoming Texas Assessment of Knowledge and Skills (TAKS) at grades 5, 10 and 11 will provide the urgent need for science to be taught on a consistent basis. Administrators and teachers must ensure that the importance of science education is taught at an early age. The skills of students must be progressive as they acquire knowledge in a conceptual manner to include: 1) reasoning techniques; 2) application of learning across disciplines; 3) ability to make evaluations; and 4) competence in the use of information technology as a way of life. Hands-on, minds-on, inquiry-based instruction must be the norm for K–12 science. Consequently, students who have not engaged in the appropriate number of science courses with the proper degree of academic rigor are simply not prepared for success in science, mathematics and engineering in college or related fields in the workforce.
- Vacancies, teacher shortages and teacher retention are issues that continue to plague the stability of our schools. Qualified and certified science, mathematics and technology teachers continue to be difficult to hire. The District has struggled with an ever-growing pool of inexperienced and uncertified teachers for several years.

  Action taken: The District has institutionalized several successful measures to address teacher shortages. They include: 1) the Alternative Certification Program which has the distinction of being a model for teacher recruitment; 2) certified science and mathematics teachers earn an additional $1000.00 per year; 3) Campus Instructional Leadership Teams (CILT) at each campus; 4) Grow Your Own Program; and 5) retired teachers who share teaching assignments.
- Inadequate laboratory facilities affect successful science instruction.

  Action taken: The new bond package for the District will ensure new science laboratories for some schools and renovations for others.
- The infrastructure is inadequate to meet technological needs of classrooms. Computers are needed for all students and teachers to access information on a daily basis. Teacher training on the use of various kinds of software and technology continues to be an issue.
- Professional development must engage teachers in deep training of content in a conceptual manner. Training must go beyond the *"sit and get"* to include more courses at the college level to build background and competence in content. Distance learning must be accelerated to reach more teachers in critical teaching areas.
- State-of-the-art training facilities are vital for successful professional development. Training must mirror actual teaching areas that shift from the traditional classroom to embrace information technology and successful pedagogical practices.
- Prospective teachers graduate from colleges and universities with very little knowledge of how to teach urban students. DallasISD, like many other school districts, is a revolving door for many new and inexperienced teachers. Many teachers who come from various noneducational industries are ill equipped to successfully teach our students.
- Assessment practices and benchmarking that have focused on reading, mathematics and writing must now include science. The thought process, that "what is tested is taught" seems to be the driving force as to what is taught. Therefore, it is difficult to implement science teaching on a consistent basis in grades that are not assessed by the State. Accountability is a huge determinant for what is taught in schools. For example, the level of implementation of teaching elementary science is lacking. The upcoming TAKS will be a driver in how we structure daily schedules in elementary classes.

Programs and activities in the Dallas Independent School District that have been effective in addressing the challenges identified above.

- **Urban Systemic Initiative (USI)/Urban Systemic Program (USP)**—In 1994 the District was awarded a five-year $15,000,000 cooperative agreement by the National Science Foundation. The cooperative NSF funds were instrumental in setting the stage for systemic reform. These funds provided support

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for standards-based programs that include Full Option Science System (FOSS), Chemistry in the Community, and Science Education for Public Understanding Program (SEPUP). Technology integration during professional development helped to upgrade a large number of classrooms. Consultants were hired to bring state of the art training to the district. One of the most important components was the addition of specialists and lead science and mathematics teachers who were deployed to each area to provide technical and clinical support to K–12 mathematics and science teachers.

In 1999, the District was awarded a (3) year cooperative grant with a (2) year option to renew in the amount of $11,600,000 to accomplish systemic reform through the convergence of resources and increased partnerships.

- **The DallasISD Environmental Education Center** is a unique 500-acre campus that provides daily field experiences in the form of 1–2 hour TEKS/TAKS based programs taught by certified teachers/naturalists. In addition to field experiences, students also visit the museum area, which provides interactive information on a variety of life and earth science topics, opportunities for career exploration, and hands-on discovery on North Texas ecosystems. Professional development for teachers includes innovative ways to integrate art, social studies, mathematics and reading in a effort to emphasize the importance of protection and preservation of our living and nonliving natural resources in the global community.
- **Texas Instruments** provides support for state of the art training and financial support for Advance Placement courses. This partnership has been a valuable link to student and teacher preparation, which contributed to an increase in the number of students of all groups. The number of students enrolled in pre-honors and advanced science and mathematics courses in the last three-seven years continue to increase. This number reflects an increase in the number of students who are taking SAT/ACT examinations. Significant improvement is a major goal for students.
- **STARS program** is a one of a kind program in the metroplex that is unique to students in the DallasISD. A collaboration between the University of Texas Southwestern Medical School provides summer internships for DallasISD students over a 4-week period each summer. Students are paired with resident scientists to study a variety of research areas in science. Middle and high school teacher internships and workshops continue to enhance background knowledge in science education.
- **Master of Arts in Interdisciplinary Science (MAIS)** is a collaborative Master's degree program between the University of Texas at Arlington and the DallasISD. This program was approved in the fall of 2000. Approximately 60 teachers (elementary, middle and high school) have enrolled in the program. The first group should graduate December 2002. The goal is to improve student performance by increasing the content knowledge of teachers in a conceptual manner.
- **Baylor College of Dentistry** provides both summer and year-round programs that target inner-city students to work on-site with professionals to learn about a variety of health care issues and careers around dentistry. This program is entering its fourth (4th) year.
- **The City of Dallas** offers content rich opportunities for students and teachers to participate in quality science experiences through informal science institutions partnered with the DallasISD. We work very closely with The Science Place, Dallas Zoo and Aquarium, Discovery Gardens, Dallas Museum of Natural History, Dallas Arboretum, Dallas Parks and Trees are just a few of the many partners with a focus on science education.
- **District's PK–8 Mathematics, Science and Technology (MaST) Fair** provides opportunities to participate in a district-wide competition for elementary and middle school students. The goal is to excite and build the knowledge base of science, mathematics and technology. The quality and quantity of projects have shown improvement for the past four years. Parental participation is at an all-time high. In February 2002, more than 1000 parents attended the awards ceremony for the 11th Annual DallasISD MaST Fair Awards Ceremony. Students also participate successfully in local, State, National and International competitions.

What elements of these programs require additional attention to enable full achievement of your goals? What additional resources might further facilitate expansion of your program or its implementation elsewhere and what new programs might you envision at the National Science Foundation?

Partnerships and collaborations require additional attention and awareness for greater participation. Training and employment opportunities that guarantee jobs in the business community would offer an incentive for participation. Connections with persons who are committed to building a qualified workforce would serve to assist students in making informed decisions about life and their role in society.

At all levels, we need to increase the awareness of programs for parents and educators who will ensure student success. Additional human resources are needed to provide support and training for Mathematics, Science and Technology (MST) teachers.

What is the need for a diverse and scientifically literate workforce for the 21st Century?

All students need to have a solid education in science, mathematics and technology to be able to make informed decisions in a society that changes on a daily basis. Adults must embrace the need to accelerate literacy in science, mathematics and technology for the safety and security of America and the Universe.

Illuminate the Dallas Independent School District's preparation in the National Science Foundation initiatives to improve the quality of math and science instruction at the K–12 level.

Current Status

The Dallas Independent School District has earned public trust in the Dallas community and on State and National levels with Dr. Mike Moses as the General Superintendent. The stability of his leadership has brought a welcomed change toward a renewed focus for the education of all students. Among the accomplishments that we are proud of include: improvements on assessments; passage of the largest bond package for a school district in the nation; a state of the art professional development program; and clear guidelines for expectations of all personnel, to name a few.

The Dallas Science Plan embraces the vision of the National Science Education Standards: All students, regardless of age, gender, cultural or ethnic background, disabilities, aspirations, or interest and motivation in science, should have the opportunity to attain high levels of scientific literacy. Our major goals are to:

1. Promote scientific literacy as an intricate part of all students' educational experiences to ensure that science instruction is relevant, interesting, and challenging;
2. Develop and implement a conceptual/theoretical K–12 curriculum that is aligned with both State and National content standards and assessments;
3. Ensure science literacy for all students by providing equity in the dissemination of standards based resources and equipment;
4. Provide professional development for K–12 teachers that includes "best practices" in content and integration of science, mathematics and technology;
5. Provide guidance for students to enter into higher education/work force with the skills to succeed; and
6. Improve collaborations with colleges, universities, businesses, and organizations to assist with greater opportunities for teachers to become more knowledgeable and certified in science.

BIOGRAPHY FOR NARVELLA R. WEST

Summary: An experienced administrator with over 32 years of professional experience at the campus, area and central administrative levels. Expertise includes: 1) the design and implementation of district-wide science curricula and professional development for K–12 science; 2) management of science budget (federal and general operating); 3) supervision of staff and special programs; 4) development of strategic plans and reports; and 4) collaborative efforts with various departments and entities in the areas of school improvement and systemic reform.

Objective: To obtain a challenging position with the Dallas Independent School District utilizing knowledge and skills to ensure that District goals are met for all students.

Professional Experience

2001–Present—Executive Director, Science Department, Dallas Independent School District, Dallas, Texas

Duties/Responsibilities: Coordinate the District's K–12 Science Program. Interpret policy, philosophy, vision and trends at the District, State and National levels to ensure consistency for student and teacher success. Develop and coordinate comprehensive curricula that incorporate Texas Essential Knowledge and Skills (TEKS), National Standards, mathematics and technology integration. Coordinate textbook adoptions. Revise and develop curricula that is aligned with TEKS/TAKS and new State adopted textbooks. Coordinate professional development for teachers and administrators to ensure equity and quality experiences for students. Monitor safety issues in science classrooms and labs. Provide technical support to areas, campus personnel and the community. Serve as a spokesperson for the importance of science education for all students. Work with other departments, businesses and institutions to ensure collaborations and opportunities for teachers and students. Manage the budget and supervise staff for the Science Department.

1998–2001—Director, Science Department, Dallas Independent School District, Dallas, Texas

Duties/Responsibilities: Coordinate the District's PK–12 Science Program. Interpret policy, philosophy, vision and trends at the District, State and National levels to ensure consistency for student and teacher success. Develop and coordinate comprehensive curricula that incorporate Texas Essential Knowledge and Skills (TEKS), National Standards, mathematics and technology integration. Coordinate professional development for teachers and administrators to ensure equity and quality experiences for students. Monitor safety issues in science classrooms and labs. Provide technical support to areas, campus personnel and the community. Serve as a spokesperson for the importance of science education for all students. Work with other departments, businesses and institutions to ensure collaborations and opportunities for teachers and students. Manage the budget and supervise staff for the Science Department.

1993–1998—Administrative Specialist IV, Area 5, Dallas Independent School District, Dallas, Texas

Duties/Responsibilities: Assisted with operations of schools. Provided technical support to principals, teachers and support staff. Monitored the implementation of CIPs and initiatives of the DISD. Served as a liaison for programs that involved secondary schools and colleges/universities. Attended meetings and addressed groups in schools and the community. Provided technical support to campuses during budget preparations and low performing campuses. Other duties as assigned by area superintendent.

1991–1993—Secondary Specialist III, Science Department, Curriculum and Instruction Division, Dallas Independent School District

Duties/Responsibilities: Assisted with the coordination of science programs, specializing in secondary curriculum, instruction and programs. Coordinated local, regional and state competitions. Managed the ESEA II science budget. Served as a TTAS second appraiser. Monitored science classes and surveyed labs for safety compliance. Selected and provided oversight of science curriculum writers for 7–12 science. Other duties as assigned by the director.

1976–1991—Science Teacher, Thomas Jefferson High School, Dallas Independent School District

Duties/Responsibilities: Taught Biology, Pre AP Biology, Chemistry, Physical Science, Environmental Science, and AP Biology. Other duties included sponsoring the Senior Class, TTAS appraiser of science teachers at W.T. White High School, department chairperson, science fair coordinator and Principal's Advisory Committee.

1970–1976—Science Teacher, Cary Middle School, Dallas Independent School District

Duties/Responsibilities: Taught Pre Honors Biology and Physical Science. Other duties included Student Council Sponsor, department chairperson, science fair chairperson, and co-sponsor of Varsity Cheerleaders.

Education

1994—University of North Texas, Denton, Texas; Doctoral student

1993—Texas Women's University, Denton, Texas; Mid-Management Certification—Educational Administration

1978—Prairie View A&M University, Prairie View, Texas; Master of Science—School Administration
1969—Bishop College, Dallas, Texas; Bachelor of Science—Biology

Certifications

Texas Professional Mid-Management
Texas Provisional Secondary—Science

Professional Affiliations

Vice President of the Dallas Audubon Society
National Science Teachers Association
Science Teachers Association of Texas
National Association of Biology Teachers
Metroplex Association of Science Supervisors
Texas Urban Science Committee
Dallas Regional Association/nabse
Kimball High School PTA and Booster Club
Volunteer for OUTREACH 5000 Breast Cancer Awareness
Delta Sigma Theta Sorority, Inc.
Association for Supervision and Curriculum Development

Awards/Recognition

1999—Honorary Member of the Texas Agriculture Commission
1995—Service Award, Lancaster/Kiest Branch Library
1991—25 Years Membership, Delta Sigma Theta Sorority, Inc.
1990—Scholarship to Johns Hopkins Space Consortium
1990—Outstanding Science Teacher Award, Da11asISD
1989—EXXON Excellence in Teaching Award, $1000.00
1988—Nominee, Junior League Innovative Teacher Award
1987—Dedicatee, Thomas Jefferson High School's Yearbook
1986—Teacher of the Year, Thomas Jefferson High School
1975—Teacher of the Year, Cary Junior High School

References

Dr. Frederick D. Todd, 3434 South R.L. Thornton Frwy., Dallas, Texas 75224; (214) 932–5062
Mr. Eugene Young, Kimball High School, 3606 Westmoreland Rd.; (972) 502–2100
Dr. Aretha Jones, 542 Woodacre Drive, Dallas, Texas 75241; (214) 376–2383
Mrs. Doris Peterson, 525 Bright Angel, DeSoto, Texas 75115; (972) 224–5986

Dallas Independent School District

April 19, 2002

To: Chair Boehlert
Committee on Science

From: Narvella West, Executive Director - Science Department

Subject: **Finance Information – Science Department/Urban Systemic Program**

The finacial summaries of the Science Department and the Urban Systemic program are listed below.

Science Department

Fiscal Year	General Operating (199)	Eisenhower (210)	Title I (211)
1998-1999	252,198.00	206,216.44	1,358,821.00
1999-2000	250,586.00	297,792.00	1,110.848.00
2000-2001	190,996.00	430,536.85	3,034,595.00
2001-2002	233,529.00	206,667.23	493,574.00

Urban Systemic Program - attachment

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Award number 9908168 National Science Foundation

DISD - USP

Year	Amount
Year 1 : 09/01/99 to 08/31/00	$ 2,700,000
Infinity Project: 08/02/00 Supplemental Funding	$ 247,080
Year 2 : 09/01/00 to 08/31/01	$ 2,800,000
Year 3 : 09/01/01 to 08/31/02	$ 2,500,000
Subtotal:	**$ 8,247,000**
Year 4 : 09/01/02 to 08/31/03	$ 2,000,000
Year 5 : 09/01/03 to 08/31/04	$ 1,600,000
Total:	**$ 11,847,000**
Total Award # 9908168 without Supplemental Funding for Infinity Project:	**$ 11,600,000**

Mr. SMITH. Thank you.
Dr. Orsak.

STATEMENT OF GEOFFREY C. ORSAK, DIRECTOR, THE INFINITY PROJECT FOR SOUTHERN METHODIST UNIVERSITY

Dr. ORSAK. Thank you, Mr. Chairman and Congresswoman Johnson.

I'm Geoffrey Orsak, Executive Director of the Institute for Engineering Education at SMU, and Director of the National Engineering Program called The Infinity Project. I'm very grateful to be able to offer testimony to your Subcommittee on H.R. 3130 and how it can best impact programs such as mine.

The Tech Talent Bill recognizes how valuable a plentiful, diverse, and highly skilled workforce is for our Nation's families, economy, and national security. It also recognizes how important knowledge in engineering, science, and technology is to effective citizenship in the 21st century.

As someone working on the front lines trying to bring engineering and technology education to schools across the country, from right here in Dallas with the Dallas Independent School District, to schools from California to Connecticut, let me try to put the scope of the problem into a human scale.

Nationally, only two out of every 100 high school graduates will ever obtain an engineering or technical degree in their lifetime, and for women and minorities the numbers are far worse. Only nine out of 1,000 women and eight out of a 1,000 minorities will ever obtain an engineering degree. This means that more than 98 percent of the graduating class in America's high schools is either not sufficiently prepared or not sufficiently motivated to pursue advanced study, which can lead to a lifetime of career growth opportunities, and might I add, some of the highest salaries available.

What does all this mean? Well, one, our economy will struggle to compete in an increasingly global marketplace without the intellectual horsepower brought about by these young minds. Two, our families, particularly those which hail from disadvantaged or minority backgrounds, will continue to be locked out of new growing high-tech economy, and three, companies will have to either import more of their talent or move of their operations off shore simply to compete in this global marketplace.

What can be done about these alarming statistics and trends? Let me offer you one small success story that I happened to be involved in, The Infinity Project. This national effort based right here in Dallas, Texas at SMU, and supported by Texas Instruments, is an innovative public/private partnership that is bringing engineering and technology education to high school students in a way that demonstrates the very best in modern engineering and at a time early enough for them to make informed choices about their future. By bringing together pre-eminent minds from engineering and K–12 education, from both public and private sectors, we've been able to create an award-winning high tech curricula that turns students on to the future of engineering, math and science, and with the generous involvement of TI we are able to support schools in nine states today so that they can offer engineering and technology education to their students right alongside English, History and PE.

This is the 21st century, essentially that will bring about remarkable engineering and scientific advances.

If we are really serious about opening opportunities to all students, so that they can effectively engage with their future, we need to ensure this material is part of every student's regular high school experience, not just reserved for the elite few.

Early results have been very promising. Sixty-five percent of the students taking our curriculum reported a very strong interest in pursuing engineering degrees at the college level, and importantly more than 50 percent of these students were women and more than 50 percent were minority. Early success of our program has enabled us to expand our operations to establish the Texas Engineering Education Pipeline, which ties together 14 of Texas' largest engineering schools to support the deployment of our curricula, technology and professional development to schools, teachers and students throughout Texas. We hope to be able to further expand this wonderful opportunity with more students across this country, and are currently in the process of working with corporate leaders to arrange for additional support.

The Infinity Project has been able to show that by establishing the right kinds of public/private partnerships, and approaching the problem with tremendous seriousness of purpose, we can make great strides to increase the opportunity for our young Americans. However, we do need your help and H.R. 3130 goes a long way to address these needs.

To close my testimony, let me make the following brief specific recommendations and observations regarding the current language in this legislation. One, it is important that H.R. 3130 have clear mechanisms for not only identifying high-performing programs, which it currently does, but also directly aid in helping these programs create systemic national change. It is critical that successful programs get the federal support to move from impacting only a fortunate few to opening opportunities for all. And two, H.R. 3130 also needs mechanisms for increasing the participation in the corporate community in addressing our workforce needs. Companies not only need to be encouraged and recognized, but they should also be rewarded for taking up this challenge.

I want to thank the Subcommittee once again for inviting me to testify, and will be happy to answer any questions you may have at the end of these presentations.

[The statement of Dr. Orsak follows:]

PREPARED STATEMENT OF GEOFFREY C. ORSAK

The Tech Talent Bill recognizes how valuable a plentiful, diverse, and highly skilled workforce is for our nation's families, economy, and national security. It also recognizes how important knowledge in engineering, science, and technology is to effective citizenship in the 21st century.

Each year, U.S. high schools graduate 2.8 million students, 800,000 of which report themselves as minority. Recent studies show that only 15 percent of these graduates will have enough math and science background to pursue engineering, technical, or scientific majors in our nation's colleges and universities. And to make matters worse, only 6 percent of our minority high school graduates meet this minimum standard. This translates into an educational system that is struggling to move students and families from the 20th century into the 21st century.

Just consider these few specifics: in a typical large public high school with 400 graduates per year and a nationally representative ethnic background, only eight students in the entire graduating class will obtain any kind of engineering or tech-

nology degree. Of these fortunate eight students, five will be white males, two will be females, and one will be a minority. This means that 392 of the 400 graduates in this typical American high school are either not sufficiently prepared or not sufficiently motivated to pursue a college degree which can lead to a lifetime of career growth opportunities, not to mention some of the highest salaries available today.

Retaining the few students studying engineering in college is also an important issue for universities today. Retention rates for minority students studying engineering have remained at a consistent 36 percent for over twenty years. At highly selective institutions this rate has averaged 49.5 percent and at non-selective institutions the rate is closer to 18 percent. A recent study examined the reasons why students who started out in science, math, or engineering (SME) majors switched to non-SME majors [2]. The study group consisted of SME majors at seven university campuses who achieved a 650 or greater SAT mathematics score. This study found that the number one reason why SME students switch to non-SME majors is lack or loss of interest. High schools and universities must make their curricula relevant to these young student's lives. The persistence of outdated programs and methods will only serve to exacerbate this problem. Something has to be done to address this trend or we will never reach a point where we are producing the diverse and highly skilled workforce that families want and companies demand.

A Negative Economic Impact

A real danger exists that we will fall behind in our production of engineers. The number of engineering graduates in 1995 nationally was 62,000, down from 76,000 in 1985 [1], resulting in a production rate of approximately the same number that graduated in 1980. Other areas of the world are making large investments in engineering education, and as a consequence are producing many times the number of engineers we produce. For example, in 1997, Europe graduated 160,000 engineers and Asia graduated 281,000 [1]. In today and tomorrow's global economy, the only alternative to leading is following.

In 1998 the cap for H–1B visas was raised to 115,000 for the fiscal years 1999 and 2000. Of the visas approved by the Immigration and Naturalization Service, over 50 percent were for computer-related occupations alone. Positions in Architecture, Engineering and Surveying accounted for another 13.1 percent. The percentage of H–1B visas approved for persons actively pursuing employment in a field requiring scientific, engineering, or technical knowledge is an astounding 76.9 percent. Between October 1999 and February 2000 this was a total of 62,490 persons recruited to technical positions within the United States from other countries. This is approximately equal to the total number of American engineering graduates. If we do not increase our commitment to engineering education, we may find ourselves being the technicians and the users, not the creators and the developers, in the technology driven world of the future.

The persistent shortage of talented graduating engineers has the potential to negatively impact our economic growth. Over the ten-year period from 1998 to 2008, Texas will have about 7,000 job openings per year for engineers. In contrast, the State produces only about 4,000 undergraduate engineers each year, which is made far worse since 25 percent of these graduates go into non-engineering professions and 25 percent leave the state.

What does this mean? One: our economy will struggle to compete in an increasingly global marketplace without the intellectual horsepower brought about by these young minds. Two: our families, particularly those which hail from disadvantaged or minority backgrounds will continue to be locked out of our new growing high tech economy. And three: companies will either have to import more of their talent, or move more of their operations offshore simply to compete.

What can be done about these alarming statistics and trends?

The Institute for Engineering Education at SMU is a federally funded initiative to promote engineering education at all levels of education throughout the United States. The Institute will lead the Nation in developing innovative programs, curricula, and technology to increase the quality, quantity, diversity and capabilities of engineering graduates within the United States of America. By maintaining a repository of information about existing programs and policy initiatives, the Institute also serves as a national clearinghouse for programs in engineering education. In addition to maintaining information, the Institute will establish assessment and tracking programs to measure the effectiveness of programs and develop continuous improvement strategies to ensure that the programs remain successful.

One of the Institutes most successful programs is the Infinity Project SM. This national effort, based in Dallas, Texas at SMU and supported by Texas Instruments, Inc. is an innovative public-private partnership that is making engineering and

technology education available to high school students in a way that demonstrates the best of modern engineering and at a time early enough for them to make informed choices about their futures. By bringing together preeminent minds from engineering and K–12 education, we have been able to create an award-winning high-tech curriculum that turns young students onto the future of engineering, math, and science by giving them a valuable education in modern engineering and technology.

The Infinity Project is designed to educate and excite a new generation of inventors, entrepreneurs, and users of technology. It is intended to give high school students a clear view of the basic fundamentals of modern technology and engineering while demonstrating how engineers envision, design, and build the devices that are powering the world around us.

The Infinity Project also addresses the severe problem in retaining engineering students in America's colleges and universities. The Infinity Project builds an interest and curiosity towards SME principles by first focusing on the end goals of engineering design—the social and practical issues of a problem and its solution—before delving into the technical details of the design. The excitement generated by the Infinity Project laboratories shows the student before they enter college that a SME career offers interesting and exciting opportunities and benefits. The training provided by the Infinity professional institutes directly addresses the need for well prepared teachers in the classroom. For these reasons, the Infinity Project acts as both a recruiting and retention tool for students pursuing degrees in scientific, technical, or engineering related fields.

The curriculum and technology design for the Infinity Project occurred over a two-and-a-half year period and involved over 20 different high school teachers, numerous University professors, advisors from professional societies, and various civic leaders. With the generous involvement of TI, we are able to support schools in nine states today so that they can offer engineering and technology education to their students right along side English, history, and PE. This is the 21st century, a century that will bring about remarkable engineering and scientific advances. If we are really serious about opening opportunities to all students so that they can effectively engage with this future, we need to ensure that engineering and technology education is part of every student's regular high school experience.

It is important to note that our program was not design to only focus on those 15 percent of the high school graduates who already have a tremendous leg up on the 21st century, rather The Infinity Project was created to ensure that a large and diverse pool of young students in America's high schools are well prepared and well motivated to pursue technical and scientific degrees in college.

Early results of the Infinity Project have been very promising: 65 percent of the students taking our curriculum reported a very strong interest in pursuing engineering degrees at the college level, and importantly, more than 50 percent of these students were women and more than 50 percent were minority. The success of our program has enabled us to establish the Texas Engineering Education Pipeline, which ties together 14 of Texas' largest engineering schools to support the deployment of our curricula and professional development for teachers to students throughout Texas. We would like to be able to further expand this wonderful opportunity to more students across this country, and are in the process of working with corporate leaders to arrange for additional support.

The Infinity Project has been able to show that by establishing the right kinds of public-private partnerships and approaching the problem with tremendous seriousness of purpose, we can make great strides to increase the opportunities for our young Americans. However, we do need your help and H.R. 3130 goes a long way in addressing these needs.

H.R. 3130

H.R. 3130 is an important step forward in promoting science and engineering education to American students. The United States is currently importing as many engineers as it graduates each year. At current rates, the supply of American engineering graduates will continue to fall while the number of H–1B visas (or requests) will continue to rise. By implementing the provisions contained in H.R. 3130 institutions of higher education can begin to build programs to help promote science and engineering education to American students.

However, it is important that H.R. 3130 contain mechanisms for not only identifying high performing programs (which it currently does) but also directly aid in helping these programs create systemic national change. It is critical that successful programs get the federal support to move from impacting only a fortunate few to opening opportunities for all.

The legislation also needs mechanisms for increasing the participation of the corporate community in addressing our workforce needs. American industry despite its

heavy reliance on the importation of scientific and engineering talent is uniquely capable of influencing future trends in education. Companies should not only be encouraged to seek partnerships with the American education system, but should be rewarded for accepting this challenge.

Conclusion

A program to promote basic engineering and technology education in the K–12 curriculum is important because it reinforces the idea that a science and engineering career can be a rewarding experience while given the student an opportunity to participate in the 21st century. Without this opportunity, students will continue to be unaware of the true nature of engineering and science professions.

In today's current K–12 curriculum, the emphasis on science and math education is put on teaching theoretical concepts that often do not attempt to make the material relevant to the daily lives of the student. A preliminary engineering education curriculum would serve to motivate students to careers in science and technology by removing the existing barriers of misunderstanding that so often discourage students from these challenging fields. The curriculum would work to make theoretical scientific concepts relevant to the daily lives of the students, offering the student the opportunity to see how their math, science, and physics courses can be applied to the commercial products they see and use. By making the connection between theoretical coursework and daily life, we hope to transform these students from end users of technology to the eventual researchers and designers who will one day change the world.

[1] U.S. Department of Education, National Center for Education Statistics, Higher Education General Information Survey (HEGIS), "Degrees and other Formal Awards Conferred," Surveys, and Integrated Post Secondary Education System (IPEDS), "Completions Surveys."

[2] Seymour, E., 1995. Revisiting the "Problem Iceberg": Science, Mathematics, and Engineering Students Still Chilled Out. *Journal of College Science Teaching,* 24: 392–400.

BIOGRAPHY FOR GEOFFREY C. ORSAK

Geoffrey C. Orsak, Ph.D., is Executive Director of The Institute for Engineering Education at SMU, Director of the national precollegiate engineering program The Infinity Project SM, and Associate Dean for Research and Development in the School of Engineering at SMU. Prior to coming to SMU, he was Presidential Fellow and Associate Professor of Electrical Engineering at George Mason University.

In addition to his current academic activities, Dr. Orsak is serving on the Executive Committees of the Texas Engineering and Technical Consortium and the Technology Leadership Academy sponsored by the Gates Foundation and based at the Texas Association of School Administrators. He also serves as Committee Member of the Texas State Board for Educator Certification on Physical Science, Mathematics, and Engineering and is the lead organizer of the newly formed Texas Engineering Education Pipeline, a consortium of fourteen of Texas' largest engineering schools aimed at increasing the number of engineers and computer scientists produced by Texas' colleges and universities. He has been a past member of the Defense Science Study Group, a program "that introduces outstanding young scientists and engineers to challenges facing national security" sponsored by The Institute for Defense Analysis, and he is the recipient of the first ever KPMG High Tech Award for Community Service for his work on The Infinity Project (2001).

Dr. Orsak is the lead co-author of the very first high school engineering textbook "Multimedia and Information Engineering" (Prentice-Hall, 2001) being used in schools in 12 states. He is a past Associate Editor for the IEEE Transactions on Signal Processing and Guest Editor for a Special Issue of the Signal Processing Magazine on Engineering Education. He has participated in organizing numerous international technical meetings including the 2001 IEEE International Symposium on Information Theory, the 2000 IEEE Digital Signal Processing Workshop, the 1999 IEEE Wireless Communications and Networking Conference, the 1996 CRASP Workshop on "Non-Gaussian Signal Processing," the 1994 Information Theory Workshop on "Information Theory and Statistics," and the 1993 IEEE International Symposium on Information Theory. In 1995 he co-founded SPEC—The Signal Processing Education Consortium, a geographically distributed consortium of faculty whose aim is to advance Digital Signal Processing education at the undergraduate level through the use of Internet technologies.

Dr. Orsak has published extensively on problems in the area of wireless communications, signal processing, information theory, and engineering education and is

quoted widely in the national media on issues pertaining to the shortage of engineers in the United States workforce.

Geoffrey C. Orsak received his BSEE, MEE, and Ph.D. degrees in Electrical Engineering from Rice University. He can be reached at gorsak@theinstitute.smu.edu

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April 17, 2002

Sherwood L. Boehlert
2246 Rayburn House Office Building
Washington, DC 20515-3223

Dear Representative Boehlert:

This letter is in support of my testimony to the US House of Representatives' Committee on Science.

My work associated with the topics for which I will testify has been supported by the National Science Foundation through a supplemental grant of the Dallas Independent School District Urban Systemic Program. And subject to final approval by DUE, the Institute for Engineering Education at SMU will also be obtaining funding from the Department of Education under the Fund for the Improvement of Secondary Education.

Sincerely,

Geoffrey C. Orsak, PhD
Executive Director

Mr. SMITH. Dr. Smatresk.

STATEMENT OF NEAL J. SMATRESK, DEAN OF SCIENCE FOR THE UNIVERSITY OF TEXAS AT ARLINGTON

Dr. SMATRESK. Thank you.

I'd like to thank the U.S. House of Representatives Committee on Science and Congresswoman Johnson for organizing today's event.

I'm Neal Smatresk, the Dean of Science at UT–Arlington and outgoing Director of the Texas Science Careers Consortium, representing about 20 major science programs in public universities around the State.

Nationwide, the number of U.S. students entering science and math in higher education is declining. We are dependent on foreign graduate students to inhabit our graduate programs in chemistry and physics. In fact, about 70 percent of physical science's graduate students nationwide are foreign nationals.

As the economies of the countries we recruit most heavily from expand and they do a better job retaining their best and brightest,

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we will experience a gap in our production of scientists, and that will be a threat to our national economy, as well as to our national security.

Now, the National Science Foundation was founded over half a century ago to address just this issue. It was clear then, as it is now, that it would take a significant effort of national scope to be sure that America would maintain its position of technological and scientific leadership in the world. Yet, along the way something curious happened. Despite the fact that our economy has been radically transformed in the past 20 years as the Sputnik area and post war baby boomers produced the largest growth of scientific and technological innovation in human history, the students in our public schools and universities are not, by and large, interested in facing the rigors of science and math curricula. They are unaware of emerging careers in areas like nanotech, genomics and proteomics, and they struggle to pass introductory college science and math classes. A generation of students who are computer literate and who are surrounded by technological miracles have rejected science and technology.

There are many immediate causes for this. In a nutshell, they are that there aren't enough well-trained and well-qualified K–12 science and math teachers. In fact, we graduated one certified physics teacher in the State of Texas last year. We are lacking leadership and connections and support from higher ed, K–12 teachers struggle to teach contemporary science that motivates students to choose science and technology careers.

While higher education is a link between K–12 education and industry, we have not partnered as effectively as we should with educators or employers, and we typically do not embrace educational and workforce development issues. And finally, we have systemically failed to instill the discipline and motivation needed for students to be successful in science and technology careers.

Another problem with the issue of teachers teaching out of discipline is that it's significant that in many of the districts where there are up to 40 percent of science and math teachers who haven't received primary certification in their chosen field that they are teaching. We have large minority populations, thus we have disproportionately disabled Hispanic and African American students from choosing science and math careers, and this is pretty critical because we are in a state that's rapidly becoming a minority/majority state.

Even well-trained teachers have difficulty keeping up with contemporary issues and careers. Most students have already rejected SMET careers by the time they get to college, and when they get to college they are poorly prepared for the rigors of science and math. Their entry level classes don't emphasize contemporary issues or careers, and we lose over 50 percent of the students who want to be science and engineering majors in their first two years.

To achieve sustaining reform, we need teachers who are well prepared in science and math content. We need to better connect contemporary issues and career development through our K–16 curriculum, and we need to instill a greater commitment to workforce development in K–12 education and higher education science and technology faculty, and in their graduate students.

Working closely with local school districts, like the Dallas Independent School District and Narvella, we've developed a series of innovative programs designed to engage teachers and raise their understanding of contemporary science and emerging careers. We've also tried to supply graduates with the science content they need to be current.

We have an MAIS program, a Master of Arts and Interdisciplinary Science, and this program has been really exciting for me because I teach in it personally, and I get to talk to teachers about what's going on right now, today. They take it back to their classroom the next day, and they inject it into their lesson plans.

We sponsor a number of events designed to motivate students, summer science and engineering programs, the ExxonMobil Texas Science and Engineering Fair and others. The same philosophy in serving the public has been developing in our own undergraduate and graduate level programs. We've been expanding public/private partnerships, internships and curriculum development. We are exposing students to more contemporary issues and preparing them for positions in a high-tech marketplace. We are working with Texas Instruments, that makes three of us, to better connect students to careers and to provide workforce development chairs that help to get the students exposed to really modern issues like nanoscience.

H.R. 3130 provides an opportunity to invest in universities who have already demonstrated their commitment to workforce development, so that they can quickly ramp up effective programs, but in the long run sustaining systemic change will require a far greater and more broadly distributed effort.

A few comments before I go. How many of you felt your math or chemistry class was relevant? Raise your hands. And, this is a technological audience. I'm happy to see as many hands up as I have, I'm not sure if we went out to a local school system we would find that many.

How many of you heard about careers outside of medicine, engineering, or allied health, when you went to school? Raise your hands. We believe that students can't choose jobs they've never heard of, and we're creating programs that connect our students to careers within the context of a rigorous traditional education. In brief, we are changing our culture to better serve the needs of the States.

Now, I have a whole class of DISD teachers, and I let them look over some of the legislation, and we talked about this, and they made one point that I thought was quite salient. They pointed out to me that we are trying to fix this problem with what appears to be a single year's pay for Alex Rodriguez of the Texas Rangers. Now, that's a staggering amount of money, don't get me wrong, that's $25 million, but it's a small amount compared to the enormity and national significance of this problem. I think Alex Rodriguez is great, don't get me wrong, but maybe, just maybe, we need more role models in science and technology and a few new heroes.

Thank you.

[The statement of Dr. Smatresk follows:]

PREPARED STATEMENT OF NEAL J. SMATRESK

Our economy has been radically transformed in the past twenty years as the Sputnik era and postwar baby boomers produced the largest growth of scientific and technological innovation in human history. An ironic side effect of the prosperity and technology produced by our new economy is that interest in science and math careers is steadily declining. It is increasingly hard for high school students to make informed career choices in a science and technology marketplace characterized by change. Few counselors or secondary teachers have kept up with the changing marketplace, and they are not equipped to help them so they defer to universities, the last link in the chain connecting education to careers.

Compounding this problem is that science and math is increasingly being delivered by faculty teaching out-of-discipline who do not have strong content training. In some metropolitan areas in Texas, as many as 40 percent of science and math teachers did not receive their primary certification in science or math. It is significant that many of these districts have large minority populations, thus we have disproportionately fewer Hispanic and African American students choosing science and math careers in a state that is rapidly becoming a minority—majority state. In the State of Texas, about 30 percent of middle school science teachers and about 20 percent of high school science teachers do not have science certification. Texas graduated one certified physics teacher and 14 certified chemistry teachers last year. We needed 400 certified physical sciences teachers. A similar shortfall occurred in middle school, and the gap is widening every year. *We need to produce more certified science and math teachers and we need teachers who can make science and math relevant by addressing contemporary issues.*

The shortage of qualified math and science teachers and the chilling effect it has had on student performance in the U.S. has been well documented in a number of prominent studies (like the TIMSS). The decline in science achievement also threatens economic development, our global position of leadership in science and technology, and even the ability of citizens to make informed choices in an increasingly technological culture. While responses to this problem typically involve developing "model" programs and quick fix professional development programs leading to reform, many of these initiatives seem to be largely ineffective. This arises for a number of reasons including:

- There are few incentives for undergraduate students or in-service teachers to pursue science and math education programs.
- Substantive content training and professional development for science and math teachers who are not trained in science or math is too expensive on their modest salaries.
- Science and math programs in higher education have given little attention to teacher training.
- Ph.D. level scientists are rarely conversant in K–12 educational problems.

The results of these K–12 problems are that most students have already rejected science, math and technology careers by the time they get to college. This is particularly true, as noted above, for minority populations. Even in groups of students interested in science, career interest surveys I have taken from large groups of secondary students reveal remarkably limited understanding of career opportunities. Invariably students identify their top career choices as doctor or marine biologist (one of the hardest fields in which to find a job), with a few interested very generically in science or engineering (most often as a result of a parent). None of them ever tells me they want to work in bioinformatics (one of the hottest and highest paying jobs for the next decade), proteomics (heralded as the next wave of biotech), or nanoscience (one of the best funded and most needed research areas). To put it plainly, *students can't get excited about or choose careers they never heard of.*

Those students who do decide on science or engineering majors in higher education are poorly prepared for the rigors of science and math, will often not get the career resource support they need, and will take freshman and sophomore classes that seem quite abstract and do not emphasize contemporary issues or linkages to careers. *Thus we lose over 50 percent of entering science and engineering majors in their first two years.*

It is fair to ask whether we have taken a considered approach in developing our undergraduate curricula to account for the fact that about 70 percent of the SMET workforce is hired by industry and 12 percent by educational institutions, with the balance working for government. In general our training focuses on molding students in our own image, yet there are several important cultural differences between the academic and industrial workplace. Industrial research is generally team

oriented, focused on a product, moves fast, is quite focused on an outcome, is funded internally and may produce a patent rather than a publication. Academic research, on the other hand, tends to be done individually, is slower paced and more self directed, can be all encompassing and may change focus because it is more about inquiry than a product, is funded from outside the institution and produces a manuscript. *While there are converging forces favoring more team science in academia, most science curricula do not address the differences between academic and industrial research, nor do they provide relevant outside work experiences.*

Summarizing the major challenges we face:

- K–12 education does not stimulate SMET career choices.
- Teachers generally cannot afford graduate education.
- A growing number of students are being taught by science teachers not certified in that area.
- Poor science teaching may disproportionately affect minority students.
- Students entering SMET fields in college are poorly prepared and often fail.
- Most SMET majors do not see the relevance of their lower division undergraduate classes and often lose their motivation.
- A corollary to this is that contemporary science and internships are only emphasized in upper division and graduate classes.
- Outside of the health professions, there is a systematic failure to get K–16 students thinking about and engaged in making SMET career choices or experiences.
- Practical learning experiences, and contextual learning are not favored in K–16 SMET learning environments.
- There is a curricular disconnect between academic and industrial employers needs.
- We are not producing enough K–12 science and math teachers and those who are trained often have serious deficits in their content knowledge.
- Ph.D. level scientists are rarely conversant in educational problems.
- The task of training science and math teachers is typically left to a small cadre of research inactive faculty or non-scientists (although they are generally quite dedicated). Because of this, science education is marginalized and mainstream issues and contemporary science may not be emphasized.

By the year 2005, the demand for biologists is expected to grow 27 percent, physical scientists 21 percent, engineers between 14%–20%, geologists 22 percent, computer scientist 35%–40%, and physicians 35 percent.

To help our students understand the opportunities in the modern marketplace and to provide them with well-defined career paths that facilitate their entry into these rewarding professions we will need to:.

- Recruit better trained K–12 science and math teachers.
- Provide funds to let science and math teachers improve their content skills in graduate programs—great science teachers produce great science students.
- Change the culture of higher education faculty and engage them more in K–12 issues and teacher preparation.
- Make accommodations for the increasing the number of graduates who will be taking industrial positions.
- Emphasize contemporary science, relevance and career counseling in K–16.
- Do a better job of recruiting and retaining SMET students.
- Provide better science and math teaching to minority communities.
- Forge stronger public/private partnerships.
- Make graduate student education in SMET reflect these values, or they will not persist.

I feel that H.R. 3130 will sere as an excellent catalyst in the higher education community to help meet the challenges outlined above. I noticed that the bill stipulates no fewer than 10 awards will be made. I am emphatic in my belief that we need to move from model to ramp up as quickly as possible, and that the funds from this and similar programs should be regionally distributed to deliver the greatest local/regional/state wide effect. Awarding more small grants would probably be more effective and would aid "front line" institutions like UT–Arlington better than making a few awards to elite institutions.

If we cannot increase K–16 SMET interest and achievement, economic development will slow, we will not meet the employment needs of our high tech industries and we will continue to have jobs seeking applicants rather than applicants seeking jobs. We have developed a number of approaches to begin addressing these problems at UTA, and in the Texas Science careers Consortium (discussed below).

What UT–Arlington Is Doing

The UT–Arlington College of Science has been a leading force in the science education and workforce development renewal effort here in Texas for the past three years. Working closely with local school districts, the College has developed a series of innovative programs designed to engage teachers, and raise their understanding of science and the remarkable careers that are emerging. This same philosophy has guided the College in developing its own programs at the undergraduate and graduate level. In brief, we believe that students can't choose jobs they never heard of, and through the leadership provided by the Dean, Chairs and faculty in the College of Science at UTA, we are creating programs that help better connect our students to careers, within the context of a rigorous traditional science education. Below is a sampling of programs that we feel have been effective in addressing education and workforce issues.

Science Education and Career Center

The Science Education and Career Center (SECC) at UTA is committed to increasing the numbers of engineering and science majors preparing for science, math, and technology professions by addressing two important goals: (1) preparing more and better qualified K–12 math and science teachers, and (2) creating workforce development programs which prepare more graduates to enter the high tech workforce. The SECC has gained statewide attention for its efforts. Its activities involve educational initiatives, curriculum development, and workforce partnerships that draw on the faculty resources of at least 15 different academic departments as well as partnerships with many of our local industries. The SECC has been supported by the Texas Workforce Commission and line item funding from the State of Texas.

The Texas Science Careers Consortium

The Texas Science Careers Consortium (TSCC). The COS at UTA was invited to develop a state wide consortium of higher educational institutions to help promote and expand workforce development and professional development programs in undergraduate and graduate science and math education. Funded by School to Careers funds and the Texas Workforce Commission, The TSCC currently has 17 institutional members and serves to spread workforce development and best science education practices around the state. The overarching mission of the TSCC is to assemble colleges of science to address critical issues facing our state's future science and technology workforce. The goals of the consortium are:

- To help inject career development information into K–16 Science and Math curricula.
- To expand workforce and career development opportunities for students in Colleges of Science across the State.
- To develop closer ties to science and technology industries in the State.
- To provide outreach opportunities for local K–12 science teachers and their students.
- To run a semiannual statewide conference called *Shaping the Future in Science and Math Education,* patterned after an NSF sponsored program (see below).
- To help organize and sponsor the Texas State Science and Engineering Fair.

Teacher Training Initiatives

- Master of Arts in Interdisciplinary Science and Master of Arts in Mathematics for Teachers were both started this year. We have just initiated two new degree programs for teachers who want to receive MA degrees: the MA in Interdisciplinary Science and the MA in Mathematics. These programs will help to produce superior science and math teachers who will motivate our children with interactive and hands on approaches in teaching science. This program has been supported and developed with the Dallas Independent School District, and by the NSF Urban Systemic Program. We have also just received funding in collaboration with the School of Education and the Hurst Euless Bedford School District to provide scholarship support for teachers in HEB. Currently 40 teachers from DISD and mid-cities schools are enrolled in MA Science and Math programs designed to lead to science educational lead-

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ership in DISD. Students complete 36 hours of instruction. Classes are taught by Ph.D./Master Teacher teams offering TEKS-compliant hands-on curricula. The classes are designed specifically to meet needs of in-service teachers and build their content skills.

- We are currently developing an undergraduate science and math teacher training track, modeled after the UTeach program at UT–Austin.
- Professional Development/Teacher Mentoring—Faculty at UTA mentor teachers and provide professional development. Two recent examples include 1) Teacher curriculum development with workforce emphasis in Bioscience in the Allied Health Fields; and 2) QuarkNet, a 6-year mentoring project in particle physics, supported by the FermiLab which will eventually reach more than 720 teachers, 100 physicists and 100,000 students.
- TSCC—South Texas Initiative. The COS is proposing to the TSCC to establish a state-wide effort to foster development of science Ph.D. programs in South Texas, and provide the higher educational support needed to improve K–16 science and math education throughout Texas.

K–12 Outreach Programs

- Summer Science Institute—A summer science school offered to Junior High and High School students for the past three years. Four week, full day, 4-day/week, program brings hands-on science and careers information to 200 students enrolled in classes in the following science disciplines: Physics, Chemistry, Psychology, Math, Biology and Geology, with Anatomy and Physiology, Bioscience/Biochemistry and Astronomy added in 2000 due to high student interest. Low teacher/student ratio gives students the opportunity to explore subjects more deeply than in the traditional classroom.
- ExxonMobil Texas State Science and Engineering Fair—sponsored by ExxonMobil, UT–Arlington, Texas Workforce Commission, the TSCC, and The Higher Education Coordinating Board, Executive Director, Neal Smatresk. This event brings 1000 students in grades 6 through 12 from around the state to compete for prizes and scholarships to TSCC schools. The College of Science is trying to build and expand the state network to involve more students.
- Job Shadowing—UTA hosts many opportunities to offer high school students the ability to work alongside a practicing research scientist.
- Career Fairs—UTA enjoys many opportunities to expose students in the community to the experiences available to them in all disciplines of science.
- Shaping the Future Conference—Sponsored by the Texas Workforce Commission and the **National Science Foundation,** this State-wide conference brought together over 200 key stakeholders from industry, K–12 education, higher education, workforce development and government to discuss the issues of education and workforce development in science, math and technology, which will result in a series of recommendations for further action and governmental consideration. Recommendations posted on the web site: *www.uta.edu/cos/theFuture*
- Shaping the Future II—We will be running this conference every two years through the Texas Science Careers Consortium. It will be centered around science and math education and workforce development. The focus will be on legislative action and science renewal efforts for K–16 education. Recommendations posted on the web site: *www.uta.edu/cos/theFuture*

Other Workforce Development Activates

- Welch Chair in Materials Sciences and Workforce Development—We have partnered with TI to receive $150,000 toward the $2 million endowed Welch Chair. This innovative program will help expedite the movement of students in physical sciences into industry, and will better connect our technology transfer efforts to the community.
- Arlington Technology Incubator. This public private partnership between UTA Science and Engineering, and the Arlington Chamber of Commerce will be funded through a variety of federal and local agencies, and will serve to better foster technology transfer. By building the incubator on campus, it will serve as an ideal venue to connect local high tech industries to our research efforts and will help to provide a "real world' working environment for our students.

- UTA Science Workforce Taskforce Meeting, hosted this past November with representatives from industry, government and education from around the state, including Joe Krier and a number of state officials.
- We have developed a number of new degree options for students that help focus their attention on career pathways. These include combined BS/MS programs that can be completed in five rather than six years that lead to a MBA or an MBA in Health Care or Biomedical Engineering. New forensic science options in Chemistry and Biology, new petroleum geosciences and petroleum engineering options, a series of new career oriented options in psychology, and a 7-year medical school program have been developed. We are also revamping our BA degree plans to better support science and math teacher education programs. A new focus will stress interdisciplinary programs oriented towards emerging fields.
- A new articulation program with UNT Health Science Center/TCOM will guarantee UTA students meeting certain standards entrance into TCOM medical school, and we are currently developing partnerships with all the programs at the UT Southwestern School of Allied Health Professions.
- We have coop training or internship training for undergraduate and graduate majors opportunities in four of our six departments.
- UTA/Community College Tech Degree Transfer Program—The COS has agreed to take technical majors from associate degree programs, and apply them towards undergraduate credit as part of a major in select areas, thus expediting transfer from CCs to 4-year programs.

UTA Undergraduate and Graduate Education

- *Alliance for Minority Participation Program,* supported by NSF. Fosters minority student recruitment into SMET through mentoring and research experiences.
- *Articulation Agreement:* UTA and UNT Health Science Center's College of Osteopathic Medicine have reached an agreement to guarantee an agreed number of qualifying students with a more streamlined, 7-year path toward their D.O. medical degree.
- *Articulation Agreement:* UTA's College of Science and UT Southwestern's School of Allied Health have developed an articulation agreement to develop paths that lead UT–Arlington's students to automatic acceptance to various health profession programs taught at UT Southwestern.
- *Options Programs:* Options programs have been added to Psychology, Geology (General/Professional, Environmental Science, Engineering), and Biology (Medicine and Society, Health Administration, Research, Sports Medicine—Applied or Orthopedics, Computer Science, Infectious Diseases, Environmental Biology, Quantitative Biology) degrees. These degree plans have a careers focus to better prepare the student for the work place.
- *5-Year Degree Plans:* The College of Science has added new 5-year degree programs: The Bachelor of Science in Biology with Masters of Science in Healthcare Administration, Business Administration and Biomedical Engineering, and proposes the following in the Psychology Department: BS/MS Industrial/Organizational; BA/MS Health Care Administration; and a BS/MS in Business Administration. At the end of these programs, the student who has met the curriculum requirements is awarded the Bachelors and Masters degrees concurrently.
- *Environmental Science and Engineering:* This program has been redesigned to provide a graduate student an integrated, multidisciplinary education, nurtured through a carefully tailored degree program requiring a breadth of understanding and mastery of a spectrum of scientific and engineering principles. Among the goals is to provide students who have earned engineering or science undergraduate degrees a common ground for interdisciplinary communication, an understanding of the environment, and competence in a discipline that will enable him or her to evaluate and solve complex environmental problems.
- *Mid-Level Math Science Certification and Composite Science Certification Programs:* Given the shortfall of qualified physics and chemistry teachers, and considering the strong market for hiring BS level physical science students, we feel the demand for physics and chemistry teachers will be met primarily through students taking composite science certification. The ideal major and the major with the most students is biology. Thus, we have added a BA Biol-

ogy program to our inventory that is targeted at creating teachers with composite science certification. The curriculum will be augmented with physics and chemistry classes for teachers.

Major Events Sponsored by UT–Arlington

- Texas Workforce Forum (Texas Workforce Commission)
- ExxonMobil Texas Science and Engineering Fair (ExxonMobil, Texas Workforce Commission, Coordinating Board, UTA, Intel, Texas Instruments and others)
- Shaping the Future I and II (NSF)
- Summer Science Institute (Texas Workforce Commission)
- Alliance for Minority Participation (AMP—NSF)
- Ronald McNair Program (TRIO Program)

BIOGRAPHY FOR NEAL J. SMATRESK

Dr. Neal J. Smatresk, Dean of Science at The University of Texas at Arlington received his Ph.D. in Zoology from the University of Texas at Austin in 1980. Following post-doctoral training at the University of Pennsylvania School of Medicine he joined the UTA Department of Biology in 1982. His research in respiratory neurobiology has resulted in over 50 papers and book chapters, and several awards from the National Science Foundation and National Institutes of Health. While maintaining an active research laboratory he has received recognition for his teaching and leadership activities, and won the Chancellor's Council Award for his teaching at UTA. He has also actively developed community science programs, science outreach programs, and teacher professional development programs throughout his career. As Chair of Biology he initiated a major career development program for allied health students sponsored by Johnson and Johnson, and more recently, as Dean, began the Texas Science Careers Consortium (TSCC), involving many of our major state universities, dedicated to improving career awareness and professional development for science and math majors. This project, funded by the Texas Workforce Commission, has helped link science education to industrial employers needs in the state. He has developed new pre- and post-service science and math education programs with the UTA School of Education to help the region meet the critical shortage of qualified science and math teachers, and is currently working with DISD on their USP program. He also directs the ExxonMobil Texas State Science and Engineering Fair, an event that gives students across the state a chance to gain direct research experience. The College of Science at UTA also hosted the NSF sponsored *Shaping the Future in Science and Math Education* Conference in 1999, and repeated the conference in 2001, with plans to run it in different regions of the state every two years. The theme of last falls conference which assembled key stake holders from education, industry and government was "Working Together to Prepare Students for Tomorrow's Careers." He is now working with the TSCC to develop partnerships with UT sister institutions in South Texas to foster better K–16 science and math programs, and economic development in the Rio Grande Valley. He is also an active participant in technology transfer through the Arlington Technology Incubator, a partnership between the Arlington Chamber of Commerce and UT–Arlington. and a number of major industrial partners, including: Texas Instruments, Lockheed Martin, and others in the North Central Texas high tech arena. For more information about the innovative programs at UTA, the Science Fair and the Shaping the Future Conferences, visit our web site at *http://www.uta.edu/cos/*

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THE UNIVERSITY OF TEXAS AT ARLINGTON

OFFICE OF THE DEAN
COLLEGE OF SCIENCE

April 18, 2002

The Honorable Nick Smith, Chairman
Subcommittee on Research
Committee on Science
U.S. House of Representatives
Suite 2320 Rayburn House Office Building
Washington, D.C. 20515-6301

Dear Congressman Smith:

I would like to thank the Committee on Science for the opportunity to testify before you during the 107th Congress on the critical need to strengthen and improve K-16 science, engineering and math education.

I currently have no NSF awards or other federal funding, but do participate in the NSF Urban System Program Advisory Board for Dallas Independent School District. Our institution participates in the NSF Alliance for Minority Participation Program. I have no other sources of funding supporting the subject matter upon which I am testifying.

Again, I appreciate this opportunity and would be pleased to provide any additional information that might be helpful to the committee.

Sincerely,

Neal J. Smatresk
Dean of Science

NJS/lln

[illegible] ARLINGTON, TEXAS 76019-0047 T 817.272.[illegible] F 817.272.2211 [illegible]

BEST COPY AVAILABLE

Mr. SMITH. Dr. Jenkins.

STATEMENT OF SEBETHA JENKINS, PRESIDENT OF JARVIS CHRISTIAN COLLEGE

Dr. JENKINS. Mr. Chairman, I'm Sebetha Jenkins, President of Jarvis Christian College, but here today representing the United Negro College Fund, UNCF.

Since 1944, UNCF has been committed to increasing and improving access to college for African Americans, and that organization remains steadfast in its commitment to enroll, to nurture, and graduate students who often do not have the social and educational advantages of other college bound populations.

Before I begin, let me say a very special thank you to our esteemed Representative from Texas and our Ranking Member on this Subcommittee, Congresswoman Eddie Bernice Johnson. She has, indeed, been a special friend and a strong supporter of UNCF over the years.

Mr. Chairman, there is no more important partner in the HBCU, the historically black college mission, than it is to provide excellence and find a partnership in excellence, and equal opportunity, than the Federal Government. The Federal Government then becomes the best partner in our providing excellence and quality educational opportunities.

I want to point out at the onset of my testimony that given the extraordinary needs of this category of special mission institutions, and the educational and family financial barriers facing our students, there is, indeed, a need. In spite of these challenges, as many of you know, HBCUs have accomplished much. They offer a wealth of resources and available talent that have benefitted our country for more than a century and are noted for their consistent standards of excellence and outstanding achievement.

Your hearing today provides the perfect opportunity to underscore how together Congress and HBCUs can address the challenges associated with preparing a 21st century workforce and strengthening and improving science, math, engineering, and technology education. Who better, who better to help address the severity of shortfalls in the science, math, engineering and technology workforce than the group of institutions that have the strongest record among all institutions of higher education nationwide and producing African American college graduates and professionals.

With the current demands of the economy for more scientific and technical workers, and the parallel under-representation of African Americans and other minorities in these fields, it is clear that this Nation still has not fully tapped into and utilized HBCUs and their human resource pool. This is not to say that UNCF member institutions and other HBCUs do not have their own unique challenges in preparing students for the globally competitive economy of the 21st century. In fact, science learning environments at HBCUs, in many instances, require either major renovation or replacement, and this information is substantiated in an NSF report that found that HBCUs accounted for 80 percent of the total deferred projects, especially in science, math and engineering on our minority serving community. And, these deferments on our campuses are generally due to the lack of funding. These deficits hinder, not only our

HBCUs' strong track record in training and graduating minority scientists, mathematicians and engineers, but also limits opportunities for faculty to conduct cutting-edge research, much of which students would be involved in as a part of their instruction.

There do exist strategies and programs, Mr. Chairman, for us to draw upon in addressing the issue before the Committee today. My statement for the record outlines both those private sector efforts, in which UNCF has taken a leadership role to support students pursuing SMET careers and the poor federal initiatives at the National Science Foundation upon which all HBCUs depend on to expand and to strengthen the individual student and institutional capabilities in theses areas.

I wish to focus then on NSF programs that are the nucleus of the federal activity in this regard. Jarvis Christian College's experience with the NSF programs, as well as those of other HBCUs, while beneficial in the short term is restricted for the most part. The reason for this is explained simply, a mere 1 percent of the more than $2.7 billion in NSF funding that went to all institutions of higher education went to HBCUs. How can HBCUs, let alone this Nation, seriously aim to increase the number of minority mathematicians, scientists and engineers, minority math and science teachers, not to mention address the under-performance of minority students in these subjects, with this obvious funding disparity?

The recommendations that I would like to offer this Committee to address the national workforce shortages in these fields are then as follows: Congress should modify existing authority to establish an EPSCoR-like program for minority serving institutions, MSIs, that would allow the NSF's poor HBCUs and MSI programs to be sustained and expanded, as well as allow for the creation of a new effort to address the SMET's teaching and learning infrastructures at HBCUs.

Second, Congress and NSF should support an HBCU centers program for the production of minorities K–12 math and science teachers and other relevant professionals. These centers, which could be a model for replication, would bring to the training process state-of-the-art training and technologies for, not only undergraduate math and science matriculates, but also could be adopted to math and science teachers in the workforce.

Adequate funding for these efforts should be provided. Legislation that this Committee is deliberating could certainly and readily incorporate these ideas.

Members of the Committee, programmatic impacts including recruitment tools for our students, research and technology integration into curriculum reform, and raised educational expectations are a few of the positive effects we can expect with these recommended investments. Societal returns include not only an adequate supply of scientists and engineers, but also an array and diversity in the workforce.

Mr. Chairman, I appreciate the time you've given me to present the views and recommendations of the United Negro College Fund, and I offer you the vast resources and talents at our HBCUs in order to address the critical national issues at hand.

Mr. SMITH. Dr. Jenkins, thank you.

[The statement of Dr. Jenkins follows:]

PREPARED STATEMENT OF SEBETHA JENKINS

Good afternoon, Mr. Chairman and other distinguished Members of the Subcommittee. I am Dr. Sebetha Jenkins, President of Jarvis Christian College and am here on behalf of the United Negro College Fund (UNCF), the Nation's oldest and most successful African American higher education assistance organization that is led by William H. Gray, III, President and CEO. Since 1944, UNCF has been committed to increasing and improving access to college for African Americans. The organization remains steadfast in its commitment to enroll, nurture, and graduate students who often do not have the social and educational advantages of other college bound populations. Before I begin my testimony, I want to say a special thank you to the esteemed Representative from Texas and Ranking Member on this Subcommittee, Congresswoman Eddie Bernice Johnson. She has been a special friend and strong supporter of UNCF over the years. Her leadership on behalf of the Nation's historically black colleges and universities (HBCUs) in the areas of science, mathematics, technology and engineering is second to none.

I am especially pleased to share with this subcommittee the perspectives of the historically black colleges and universities (HBCUs) that, along with Jarvis Christian College, comprise UNCF. There is no more important partner in the HBCUs mission to provide excellence and equal opportunity in higher education than the Federal Government. Therefore, in my view and that of UNCF, we welcome President Bush's leadership in making HBCUs a priority—while calling upon the Congress—in order to realize the full potential of our institutions and to meet the academic needs of the students we serve.

As many on this subcommittee know, this nation's HBCUs offer a wealth of resources and available talent that have benefited our country for over more than a century. Whether it is the fact that they produce a disproportionate number of the African American public school teachers, or their noteworthy production of Black scientists, mathematicians and engineers, historically black colleges and universities are poised to offer even greater things than ever before.

This is the case even though UNCF member institutions and other HBCUs enroll large numbers of poor students, whose parents are unable to help pay college costs. In fact, 50 percent of all UNCF students come from families with incomes less than $35,000. Over ninety percent of all UNCF students receive some form of financial assistance, and sixty percent of UNCF students are first-generation college students. Despite their remarkable contributions, compared to other colleges, private black colleges have very small endowments and cannot fall back on sizable numbers of wealthy alumni. The average endowment of UNCF schools for the 1998–1999 academic year was $22.2 million. In spite of these challenges, UNCF students and member institutions have accomplished much. They are noted for their consistent standards of excellence and outstanding achievements.

Moreover, given the demographic changes taking place in this nation, investing more in HBCUs is, in actuality, about the future prosperity of this nation. Statistics show that minorities will comprise more than 50 percent of the U.S. population by 2010. It makes sense then that Congress maintain a leadership role in recognizing and reaffirming support of HBCUs, a position that is consistent with the world's changing demographics and necessary to secure our nation's interests at home and around the world.

The hearing today on preparing a 21st Century workforce and strengthening and improving K–12 and undergraduate science, math, and engineering education focuses in on one of the major areas where the Congress can play a major role in taking advantage of the vast resources and talent our HBCUs bring to this nation. Who better can address the severity of shortfalls in the science, math, engineering, and technology workforce than the group of institutions that has the strongest record among all institutions of higher education nationwide in producing African American college graduates and professionals:

- HBCUs produce 35 percent of all the African American scientific and technical experts in the United States according to the U.S. Census Bureau.
- Nearly a third of America's estimated 94,000 black engineers were trained at HBCUs as reported in *U.S. Black Engineer and Information Technology* magazine.
- From 1975 to 1992, three-quarters of African American women receiving Ph.D.s in biology came from historically black institutions.
- From 1985–1995, HBCUs graduated 48.1 percent of all African American mathematicians.

- HBCU and specifically UNCF science and engineering graduates whose achievements are notable include: Dr. Walter Massey, former NSF Director, former provost of the University of California system, and now President of Morehouse College; and Dr. Luther Williams, former Associate Director of NSF's Directorate on Education and Human Resources, former President of the Atlanta University Center, and now a private consultant and expert on science, mathematics, engineering, and technology education.

With the current demands of the economy for more scientific and technical workers, and the parallel under-representation of African Americans and other minorities in these fields, given the positive track record of HBCUs, it is clear that this nation still has not fully tapped into and utilized HBCUs and their human resource pool.

Further, HBCU graduates figure prominently in efforts to bolster our public schools. A great many of HBCU teaching majors express a desire to turn to their communities, and mentor and teach the very students this subcommittee is concerned underperform in math and the sciences at the K–12 level. We cannot underestimate the value of the development of the human capital on HBCU campuses to the overall goal of influencing learning at all levels.

Even with these considerable accomplishments, UNCF campuses and other HBCUs must meet the challenges of preparing their students for the globally competitive economy of the 21st Century with limited resources compared to other institutions of higher education. Even students that are well prepared for SMET coursework at the collegiate level are sometimes hindered by the lack of state-of-the-art facilities on our campuses. UNCF schools are experiencing increased demands for and difficulty with improvements in science learning environments, while at the same time experiencing a rapidly increasing student population and student expectations.

HBCUs have inadequate amounts of science and engineering research space compared to other research-performing institutions. Existing research space in many instances requires either major renovation or replacement. In 1998, according to a National Science Foundation report, HBCUs accounted for almost 80 percent of the total deferred projects, in science, math, and engineering, on minority-serving campuses due to lack of funding. These deficits not only limit the opportunities for faculty to conduct cutting-edge research and remain competitive within their respective disciplines, but also threaten the viability of HBCUs as the leading producer of African American scientists and engineers. Without adequate means to purchase equipment or instrumentation for instructional or research purposes, HBCUs struggle to maintain their strong track record in training and graduating teachers and scientists in new methodologies.

We are not without programs or strategies to address these challenges that I have noted. At UNCF, the organization has aggressively sought private funding to support scholarships for students pursuing science, math, engineering, and technology careers.

- UNCF administers the Gates Millennium Scholars Program in partnership with the Hispanic Scholarship Fund, the Organization of Chinese Americans, and the American Indian Graduate Center Scholars. This program is aimed at expanding access and opportunity to higher education for African American, American Indians/Alaska natives, Asian Pacific Americans, and Hispanic Americans enrolling in and completing undergraduate and graduate degree programs in disciplines where ethnic and racial groups are currently under-represented.
- UNCF provides numerous scholarship programs for students majoring in the science, mathematics, engineering, and technology fields. Private partners, including Oracle, Pfizer, Merck, Dell, and Coca-Cola, support these individual UNCF corporate scholars programs.

UNCF also has secured support for institutional technology capacity building, demonstrated through the Technology Enhancement Capital Campaign that is designed to strengthen the technological capacity of each of the 39 UNCF member colleges and universities. Each campus has benefited from upgraded network infrastructure and increased access to technology for students, faculty, and staff.

The focal point of efforts to address the SMET challenges at HBCUs from a federal perspective are the programs underway at the National Science Foundation's Directorate on Education and Human Resources. NSF has a broad portfolio of targeted programs designed to expand and strengthen individual student and institutional capabilities in the SMET areas at HBCUs. The five key programs that UNCF institutions primarily benefit from include Alliances for Minority Participation

(AMPS), HBCU Undergraduate Program (HBCU UP), Alliance for Graduate Education, Centers for Research Excellence in Science and Technology, and the new HBCU Graduate Science and Engineering Program.

Jarvis Christian has obtained significant funding from the National Science Foundation (NSF) through the HBCU UP program and the Physical Sciences Scholarship program. The HBCU UP program is a comprehensive program that impacts five major areas at Jarvis Christian College:

1. Curriculum reform and new initiatives
2. Honors students scholarships in the sciences
3. Facilities and infrastructure development
4. Technology and research integration
5. Outreach and/or partnerships with public schools

This existing support manifests into many positive outcomes for my campus:

- It provides leverage for recruitment and retention of science majors.
- It increases the opportunities for students through support of students' participation in science and math activities at the national and state levels.
- It supports research and technology integration in curriculum reform.

The macro effects of NSF's funding at Jarvis Christian College include: increased awareness of the national needs for a technical work force for faculty, staff, and students; raised educational expectations of a larger number of minority students; expanded existing academic programs; increased initiatives targeting rural students; supplemental teacher education program initiatives in math and science; supported programs that engage students at the K–12 levels in science, math and technology; and supported teacher and curriculum development for pre-college and undergraduate programs in SMET areas.

However, data that UNCF has reviewed indicates that whereas more than $2.7 billion in NSF funding went to all institutions of higher education, HBCUs received a mere one percent of these funds. What an obvious funding disparity and missed opportunity to strengthen and broaden the network of institutions supporting our national scientific enterprise! Moreover, these initiatives at NSF—proven successes in addressing the capabilities in science, mathematics, engineering, and technology at HBCUs—are lacking if we seriously aim to increase the numbers of minority mathematicians, scientists, and engineers; minority math and science teachers; not to mention address the under performance of minority students in these subjects.

I cannot say it any better than NSF's own Director, Dr. Rita Colwell, who told the *Chronicle of Higher Education* almost a year ago in reference to a report on women, girls in science, engineering and technology by the National Council for Research on Women, and I quote, "If women and minorities moved into this portion of the work force, there would be no shortage of scientists and engineers in this country."

Mr. Chairman, I offer on behalf of UNCF the following recommendations that would enable HBCUs, their faculty and students to become full participants in not only the federally-supported SMET education and research enterprises at the post-secondary level, but also become full partners in addressing the national workforce shortages in these fields.

- Currently at NSF, there exists the Partnerships for Innovation Program, which was originally named if I recall the Office of Innovation and Partnerships. This program is charged with—in addition to housing the EPSCoR program—examining the means of helping those non-EPSCoR institutions that receive amongst the least federal research funding expand their research capacity and competitiveness. Congress should modify existing authority to establish an EPSCoR-like program for Minority Serving Institutions (MSI). Given that HBCUs, other MSIs, and smaller research institutions are not beneficiaries of EPSCoR but clearly are those most needing research infrastructure development as EPSCoR is designed to do, an EPSCoR-like program for MSIs would support research and education through core grants and co-funding to promote linkages to NSF's other programs. This would allow for a sustained and expanded NSF HBCU Undergraduate Program and the Alliances for Minority Participation programs. It would also allow for the creation of a new effort, for example, to address the SMET teaching and learning infrastructure at HBCUs—inclusive of information technology.

  Technical assistance should be a key component of such an initiative. Also, partnerships should be required between major research institutions receiv-

ing NSF funds and institutions in this EPSCoR-like program, with an emphasis on faculty and student research exchanges.

- In addition to building new and expanded capacity and capability through an EPSCoR-like program, among the other specific activities that UNCF would like to see supported would be a HBCU "centers" program for the production of minority K–12 math and science teachers and other relevant professionals (e.g., evaluators, math and science student performance/assessment experts, etc.). These centers will serve as "test beds" and will be global in order to bring to the training process state-of-the-art training and technologies for not only undergraduate math and science matriculants, but also adaptable to math and science teachers in the workforce. As a program paradigm for HBCUs in the generic, the Center will ultimately increase the net production of math and science teachers and provide a model for replication at other HBCUs. The Centers will ultimately increase the production of African American and other minority math and science teachers in the classroom, as well as address enhanced instructional opportunities for and eliminate the achievement gaps of minority students in these subjects. Such a program might be called HBCU Math and Science Regional Teaching Centers of Excellence. Logically, these centers might also be part of the EPSCoR-like program recommended.

Of course, Mr. Chairman, Congress must ensure that sufficient authorization of appropriations is provided for such an effort. Too often, this funding is very inadequate. Moreover, once our campuses receive an initial grant, there should be an automatic renewable second grant award period. So many of the promising, fledgling initiatives begun at HBCUs falter because just as they get up and running, funding terminates before the effort has established itself to be self-sustaining.

Institutions like Jarvis Christian Colleges would get a tremendous boost from programs such as those that UNCF recommends. These recommendations can be readily incorporated into H.R. 3130, the Talent Tech Act introduced by Chairman Boehlert to encourage institutions to increase student enrollment in science and engineering disciplines. Among the policy elements of the legislation are support for programs that assist institutions of higher education in states that participate in EPSCoR and support of programs that focus directly on the quality of student learning, including those that encourage high caliber teaching and opportunities to develop new pedagogical approaches. This is exactly what UNCF suggests for HBCUs in the EPSCoR-like modification and the centers program for the production of minority teachers. Modifications as what is recommended might also encourage states to take a more proactive role in helping those non-Ph.D. degree and minority institutions like Jarvis Christian and my UNCF sister institutions.

Members of the Committee, the overall programmatic impact and societal returns on the investments that UNCF is asking Congress to consider are enormous. The same positive impact that Jarvis Christian College has experienced from its NSF grant is certain to be conveyed elsewhere. Programmatically this would include: recruitment tools for students; research and technology integration into curriculum reform; raised educational expectations; to name a few of the points I noted earlier. Societal returns include not only an adequate supply of scientists and engineers but also an array and diversity in the work force that is another highly desired outcome. I cannot emphasize enough how HBCUs could uniquely contribute to this national concern, a particularly relevant point considering the science and technology work force issues require a K–12, undergraduate, graduate continuum approach.

Mr. Chairman, I appreciate the time you have given me to present the views and recommendations of the United Negro College Fund. Clearly, strengthening the Nation's ability to produce highly qualified, skilled scientists, mathematicians, engineers, and technology professionals is a situation unlikely to change if we do not take corrective action. The vast resources and talent at our HBCUs are at this nation's disposal. UNCF looks forward to working with you to formulate additional strategies to address this critical national issue.

BIOGRAPHY FOR SEBETHA JENKINS

President, Jarvis Christian College, P.O. Box 1470, Hawkins, Texas

Dr. Sebetha Jenkins earned her Bachelor's degree in English at Jackson State University in Mississippi. She went on to Delta State University and received her Master's degree in English Education. In 1978, Dr. Jenkins was awarded a doctorate in Educational Administration from Mississippi State University (MSU).

Dr. Jenkins became the tenth president of Jarvis Christian College, January 1, 1991. Prior to her appointment as president, Dr. Jenkins had a distinguished career

as an educator and college administrator. From 1986 through December 1990, she was Assistant to the President and Director of Minority Affairs at The University of Akron in Akron, Ohio. From 1960 through 1986, she worked in the field of education in Mississippi, primarily at Coahoma Junior College and then at MSU where she was in charge of minority affairs and later Assistant to the President. In 1980, Mississippi honored her with the award for the Most Outstanding Woman in Higher Education. Five years later, MSU voted Dr. Jenkins the Most Outstanding Professional Woman. She has been recognized and received numerous awards from local, state and national organizations.

Dr. Jenkins has also been actively involved in the communities in which she has resided. She has worked with United Way, Boy Scouts of America, the NAACP and the YWCA; served as board member and president of Big Brothers/Sisters, and served as chapter charter member and in other leadership capacities with her sorority, Delta Sigma Theta Sorority, Incorporated. In Akron she was a board member of the Arthritis Foundation, Akron Community Service Center and Urban League, and the Summit County Human Services Advisory Board. She was also selected a participant in Leadership Akron and Leadership Starkville.

In Texas, she has been honored with the Hawkins Chamber of Commerce Outstanding Achievement Award in Higher Education in 1991 and the Woman of the Year Award in 1995; the Fort Worth Association of Federated Women's Club Award, 1992; The Mary McCloud Bethune Educational Award (Arkansas) 1998; Boy Scouts of America, 1993; and Top Ladies of Distinction, Lufkin Charter, 1993. She was inducted into the Black Women of Texas Hall of Fame in 1996.

Dr. Jenkins has gained national recognition while serving as President of Jarvis Christian College. Her stature has been recognized by her appointment to a number of prestigious professional organizations, commissions and boards. She has served on the boards of the Air University Board of Visitors at Maxwell Air Force Base; the Consortium of Black Doctors; the Independent Colleges and Universities of Texas; American Council on Education, Commission on Women in Higher Education; Association of Black Women in Higher Education; National Institute of Independent Colleges and Universities; the United Negro College Fund; The President's Foundation for the Support of Higher Education; American Association of University Women; The Certification of Advisory Council of the Texas Higher Education Coordinating Board; The Christian Church Foundation Board; The General Board of The Christian Church; and The Council of Independent Colleges; National Association for Equal Opportunity in Higher Education; Texas Discovery Gardens; is a member of the American Council on Education Commission on Adult Learning and Educational Credentials and is Chair of The College Fund/UNCF Council of Presidents.

In 1994, Dr. Jenkins was appointed to the President's Board of Advisors on Historically Black Colleges and Universities by President William Clinton. This singular honor places her among the major leaders in education in the Nation.

Dr. Jenkins is a distinguished educational leader and speaker. She is an expert on topics relative to higher education, equal educational and employment opportunities, women's rights, due process, and issues relating to youth. She especially enjoys interacting with the students at Jarvis Christian College.

Dr. Jenkins is the proud mother of one daughter, Jennifer, who has completed her doctoral studies in Osteopathic medicine. Additionally, Dr. Jennifer Jenkins completed post-doctoral studies with Southwestern Medical Center in Dallas, Texas, and is currently employed by Allergan Inc., Irvine, California.

HOUSE COMMITTEE ON APPROPRIATIONS

Witness Disclosure Requirement – "Truth in Testimony"
Required by House Rule XI, Clause 2(g)

Your Name: Sebetha Jenkins

1. Other than yourself, please list what entity or entities you are representing:

   UNCF

2. Are you testifying on behalf of a Federal, State, or Local Government entity?	☐ Yes	☒ No
3. Are you testifying on behalf of an entity other than a Government entity?	☒ Yes	☐ No

4. Please list any federal grants or contracts (including subgrants or subcontracts) which you have received since October 1, 1999:

5. If you answered "Yes" to question number 3, please list any federal grants or contracts (including subgrants or subcontracts) which were received by entities listed under question number 1 since October 1, 1999, which exceed 10% of the entities revenue in the year received, including the source and amount of each grant or contract to be listed:

6. If you answered "Yes" to question number 3, do any of the entities disclosed in question number 1 have parent organizations, subsidiaries, or partnerships whom you are not representing?	☐ Yes	☒ No

7. If you answered "Yes" to question number 3, please list any offices or elected positions held or briefly describe your representational capacity with the entities disclosed in question number 1: President of Council of UNCF Presidents

Signature: Sebetha Jenkins Date: 4/22/02

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Mr. SMITH. Mr. Penermon.

STATEMENT OF EZRA C. PENERMON, MANAGER, WORKFORCE DEVELOPMENT FOR TEXAS INSTRUMENTS

Mr. PENERMON. Good afternoon. My name is Ezra Penermon. I am the Workforce Development Manager at Texas instruments.

Chairman Smith and Congresswoman Johnson, I'd like to thank you for the opportunity to appear here today, to discuss the current status of K–12 and undergraduate education in mathematics, science and engineering.

Congresswoman Johnson, I'd like to commend you for your ongoing support for and promotion of initiatives that enhance math, science, engineering and technology education particularly at the K–12 level. We at Texas Instruments know your commitment is deep and passionate. We appreciate the critical role you played in securing enactment of H.R. 1858, the National Mathematics and Science Partnerships Act and are hoping for prompt action on this bill by the Senate.

In the new era of "No Child Left Behind," we have a unique opportunity to make significant strides in improving math and science education. The focus on high standards, aligned assessments, accountability and teacher quality will help drive student performance and close the achievement gap. In that light, I want to thank you for your most recent efforts to increase funding for the math and science partnerships under the No Child Left Behind Act in the Fiscal Year 2003 Appropriations bill for the Department of Education. We appreciate your continued leadership in these areas.

As you know, the semiconductor industry continues to grapple with the shortage of qualified workers and the downward trend of enrollment into technical and engineering degree plans at colleges and universities across our country. Texas Instruments is no stranger to this "War for Talent" and has taken action on a number of fronts. We have included a fairly comprehensive list of our programs and activities later in the written testimony, but I want to respond to some of the particular questions you have posed.

Our technical workforce is largely made up of two groups of people—technicians, who work in our wafer fabrication plants to maintain, troubleshoot and repair multi-million dollar high-tech manufacturing equipment, and electrical engineers who design, test, troubleshoot and sell our semiconductor products.

Technicians generally have a two-year degree from a technical program. The biggest challenge we face in attracting technicians is helping prospective candidates become aware of the opportunities that are available. Technicians' roles are largely "invisible" to the public in general. Students, parents and teachers driving by our facilities every day don't always understand the workplace hidden inside our building and that they can be a part of it too.

To that end, TI has spearheaded the development of the TI TechKNOW-Ed program, that's Technical Knowledge through Educational partnerships. This is a collaborative effort between TI, local community colleges and 22 high schools in the D/FW metroplex. The program focuses on delivering career awareness and exploration to high school students, parents, faculty/counselors

highlighting technical careers in the semiconductor industry. The program focuses on first-hand, real-world exposure including educator orientation, industry tours, job shadowing, summer faculty development institutes, and retention components, which can easily be replicated for other companies or industries. We have also established a "chip camp" to help middle school students see some of the exciting opportunities a career in our industry can offer.

TI has significantly increased our participation with community colleges and technical schools. We have identified and developed relationships with 14 targeted community colleges and tech schools in the State of Texas, donating equipment and making company-sponsored scholarships and internships available at unprecedented levels in the last 4 years. Right now, we have approximately 50 students participating in a unique work/study arrangement that allows them to gain industry experience while completing their studies. Several of these students were introduced to the program while enrolled in a dual credit program earning technical college credit while seniors in high school. We continue to work with industry partners like the Semiconductor Industry Association and the Maricopa Advanced Technology Education Center in)Phoenix, to develop industry-approved curricula designed to better prepare students entering the semiconductor workforce. MATEC, which was started with funding from the National Science Foundation, works with community colleges throughout the country, such as Richland Community College here in Dallas and Tarrant County College in Ft. Worth, to offer quality instruction relevant to the semiconductor industry.

At the engineer level, the ability to find and attract electrical engineers continues to be a challenge, even during the recent downturn. The unemployment rate for electrical engineers in 2001, arguably the toughest year ever for the semiconductor industry, was 1.9 percent. The steady decline of students graduating with a degree in this discipline since 1987 shows no signs of turning around. Last year, only 12,643 EE degrees were awarded, and for advanced degrees there are now more national-foreign nationals than domestic students receiving Ph.D. level degrees in this field.

TI has taken a number of approaches to addressing this problem by: spending more than 45 percent of our H.R. budgets on recruiting workers, acquiring companies to gain talent, spending millions of dollars each year on education programs, using the H–1B visa program, and promoting state and national level public policy initiatives.

There are many factors behind this challenge: lack of funding for higher education, poor retention of engineering students in college, lack of interest among K–12 level students in engineering, and failure to integrate community colleges into the four-year pipeline, an avenue that would open up more opportunities to minorities and women.

Let me give you two examples of our response to this challenge. Two years ago, TI and several other Texas-based companies, worked together with TechNet to promot_ legislation in Austin that would seek to increase the number of students graduating with electrical engineering and computer science degrees from Texas universities. SB 353, which ultimately passed the legislature, pro-

vides a five year $50 million public/private matching grant consortium among business, colleges and universities, and the state to address college recruiting and retention issues from a systemic perspective.

The Texas Engineering and Technical Consortium, TETC, as it is called, has just recently announced its first set of grants to participating universities. Perhaps, one of the most exciting aspects of this initiative is that it has provided the venue for bringing together business and the deans of engineering and computer science at 32 Texas schools to address issues of recruitment and retention. Currently, about 50 percent of all students who enter college intending to major in engineering fail to graduate with that degree. In many cases, it has nothing to do with academic performance. We need to do a better job of keeping those students through new and exciting curriculum, mentoring programs and faculty support. Some of the TETC grants are designed to attack that problem. The lack of a clear pathway for students in two-year schools to move into four-year schools in these disciplines cut off the potential of many students, particularly, those from under-represented groups to pursue degrees in this area. TETC is an attempt to address these "bridging" issues as well.

Our efforts with TETC has made us avid supporters of the Technology Talent bill, H.R. 3130, currently pending before the House Science Committee. The Tech Talent bill, which from our perspective, shares the same objectives as TETC, would provide a natural federal partner, the NSF, to our efforts to increase the number of EEs and computer scientists. Texas Instruments encourages the Committee to take prompt action on this bill and to make it flexible enough to support consortia like TETC in addition to the individual programs from universities and colleges. SIA, TechNet, the BRT, and NAM all support this legislation.

In 1999, the company, working with engineering professors at Southern Methodist University, helped design the first high school engineering course in the Nation that incorporates the fundamentals of digital signal processing at Townview Science and Engineering Magnet in the Dallas Public School system. Basically, it enabled students to see first hand how science, math and technology come together to create cool products, like Sony Music clips. Called the Infinity Project, the class is now offered in more than 40 schools in 10 states and is showing impressive results in keeping students interested in technology careers. In fact, Texas colleges are now beginning to offer it as a freshman engineering course—through TETC—to keep students interested and engaged early on in their college careers. Infinity has received funding from NSF to help train more teachers and replicate the program to broader groups of students across the country.

TI also continues to work with trade associations such as the SIA and the Semiconductor Research Corporation on workforce development initiatives designed to attract, retain and enable member companies to recruit engineers from U.S. universities. Education is our highest priority for corporate philanthropy and volunteerism at TI. We believe educational excellence is a national imperative, a critical building block for American's economic vitality and for the quality of life in our communities. With the availability of a highly-

educated workforce, our individual visions and aspirations will be realized.

While these are all noteworthy endeavors, yet we at TI realize that this is not enough. As we enter an age of occupations increasingly driven by technological innovations, it is imperative that we learn to partner with educational institutions on a sustained basis in an effort to give students the skills necessary to compete in a global economy.

Thank you for the opportunity to participate in this hearing. I'd be happy to answer questions for you.

Mr. SMITH. Thank you.

[The statement of Mr. Penermon follows:]

PREPARED STATEMENT OF EZRA C. PENERMON

Good afternoon, my name is Ezra Penermon, I am the Workforce Development Manager at Texas Instruments. Chairman Smith and Congresswoman Johnson, I'd like to thank you for the opportunity to appear here today to discuss the current status of K–12 and undergraduate education in mathematics, science and engineering.

Congresswoman Johnson, I'd like to commend you for your ongoing support for and promotion of initiatives that enhance math, science, engineering and technology education particularly at the K–12 level. We at Texas Instruments know your commitment is deep and passionate. We appreciate the critical role you played in securing enactment of H.R. 1858, the National Mathematics and Science Partnerships Act and are hoping for prompt action on this bill by the Senate.

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Texas Instruments Workforce Development/Education Efforts

As you know, the semiconductor industry continues to grapple with the shortage of qualified workers and the downward trend of enrollment into technical and engineering degree plans at colleges and universities across our country. Texas Instruments is no stranger to this "War for Talent" and has taken action on a number of fronts. I have included a fairly comprehensive list of our programs and activities later in the testimony, but I want to respond to some of the particular questions you have posed.

Our technical workforce is largely made up of two groups of people—**technicians** who work in our wafer fabrication plants to maintain, troubleshoot and repair multi-million dollar manufacturing equipment; and **electrical engineers** who design, test, troubleshoot and sell our semiconductor products.

Technicians generally have a two-year degree from a technical program. The biggest challenge we face in attracting technicians is helping prospective candidates become aware of the opportunities that are available. Technician roles are of largely "invisible" to the public in general. Students, parents and teachers driving by our facilities everyday don't always understand the workplace hidden inside our building and that they can be part of it too.

To that end, TI has spearheaded the development of the **TI TechKNOW–Ed program** (**Tech**nical **Know**ledge through **Ed**ucational partnerships)—a collaborative effort between TI, local community colleges, and 22 High Schools in the D/FW metroplex. The program focuses on delivering career awareness and exploration to High School students, parents, faculty/counselors highlighting technical careers in the semiconductor industry. The program focuses on first-hand, real-world exposure including educator orientation, industry tours, job shadowing, summer faculty development institutes, and retention components, which can easily be replicated for other companies/industries. We have also established a "chip camp" to help middle school students see some of the exciting opportunities a career in our industry can offer.

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At the **engineer** level, the ability to find and attract electrical engineers, continues to be a challenge, even during the recent downturn. The unemployment rate for electrical engineers in 2001—arguably the toughest year ever for the semiconductor industry—was 1.9 percent. The steady decline of students graduating with a degree in this discipline since 1987 shows no sign of turning around. Last year only 12,643 EE degrees were awarded. And for advanced the degrees, there are now more foreign nationals than domestic students receiving Ph.D. level degrees in this field.

TI has taken a number of approaches to addressing this problem by:

- Spending more than 45 percent of our HR budgets on recruiting workers
- Acquiring companies to gain talent
- Spending millions of dollars each year on education programs
- Using the H–1B visa program
- Promoting state and national level public policy initiatives.

There are many factors behind this challenge: lack of funding for higher education, poor retention of engineering students in college, lack of interest among K–12 level students in engineering and failure to integrate community colleges into the four year pipeline—an avenue that would open up more opportunities to minorities and women.

Let me give you two examples of our response to this challenge:

Two years ago, TI and several other Texas based companies worked together with AeA and TechNet to promote legislation in Austin that would seek to increase the number of students graduating with electrical engineering and computer science degrees from Texas universities. SIB 353 which ultimately passed the legislature, provides a 5-year $50 million public-private matching grant consortium among business, colleges and universities, and the state to address college recruiting and retention issues from a systemic perspective.

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Our efforts with TETC have made us avid supporters of the **Technology Talent bill, H.R. 3130,** currently pending before the House Science Committee. The Tech Talent bill, which from our perspective, shares that same objectives as TETC, would provide a natural federal partner—the NSF—to our efforts to increase the number of EEs and computer scientists. Texas Instruments urges the Committee to take prompt action on this bill and to make it flexible enough to support consortia like

TETC in addition to individual programs from universities and colleges. SIA, AeA, TechNet, the BRT, and NAM all support this legislation.

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TI also continues to work with trade associations such as the SIA and the **Semiconductor Research Corporation (SRC)** on workforce development initiatives designed to attract, retain and enable member companies to recruit engineers from U.S. universities. Education is our highest priority for corporate philanthropy and volunteerism at Texas Instruments. We believe educational excellence is a national imperative—a critical building block for American's economic vitality and for the quality of life in our communities. With the availability of a highly educated workforce, our individual visions and aspirations will be realized.

Thank you for the opportunity to participate in this hearing.

Inventing the Future Through Education at TI

TI's vision in education is broadbased. Particularly in **K–12 education,** we look to create opportunities for fundamental change by developing programs that can be replicated elsewhere. We're placing more emphasis than ever before on core areas, such as math and science, to help foster our next generation of high-tech workers. And we're also expanding our focus on educational opportunities for women and minorities in order to increase their representation in technical fields.

K–12 Education

For more than 15 years, TI has been a leader in the effort to advance assessment and accountability processes in the Texas public schools, an approach that has been nationally recognized. The education process offers many opportunities to engage and excite children about mathematics and science. TI believes this long-term investment is critical to preparing today's students for 21st century jobs and helping the United States to remain competitive in the global economy.

- For example, working with a local principal and teachers, TI employees have developed the **Academic Improvement Management (AIM) software,** a tool now used throughout the school district, to give teachers and administrators a precise way to measure the academic progress of pupils in the classroom. TI executives have also teamed up with administrators and teachers to apply best practices from the business world through the **Executive Resource Model,** a program that has been adopted by numerous Dallas corporations through the Greater Dallas Chamber of Commerce.
- Since the early 1990s, TI engineers have been helping high school students put their competitive spirit to work in a robotics competition called **Texas BEST (Boosting Engineering, Science and Technology)** that challenges students to build remote controlled robots. Each year the competition attracts entries from nearly 200 schools and more than 2,000 students across several states.
- TI also supports and promotes the **Advanced Placement** Incentive Program, designed to encourage students to take more rigorous college-level course work in high school and provide incentives for both teachers and students for their successes. For years TI has been a national sponsor of **MATHCOUNTS,** an exciting competition that gives thousands of seventh and eighth grade "mathletes" a chance to race against the clock to solve challenging mathematics problems.
- On a national level, TI has worked closely with the NSF in its **Urban Systemic Initiative** and Urban Systemic Programs over the last several years. TI worked with NSF and urban school districts to identify an approach that included educator training. NSF provided the program, the structure and partial funding. Independent School Districts provided the plan, instructional resources (teachers), and the drive for success. For the first time, districts were provided a forum in which they could dialogue and share best practices. TI

provided training expertise and technical assistance, and applied proven best practices, which included aggressive follow up and ongoing support. This partnership approach resulted in "train the trainer" training of over 2,500 teachers in over 40 cities since 1998. TI also supports the National Science Teachers' Association Building a Presence for Science Program to assist school-based mentors in improving teaching and learning of scientific subjects in every school in the United States.

- Through T^3 **("T-Cubed"), Teachers Teaching with Technology**™, Texas Instruments provides professional development services to help schools and teachers improve teaching and learning through the successful integration of hand held technology into the classroom. Since 1986, T^3 has reached over 100,000 teachers worldwide through 1- to 5-day math and science workshops. During this effort we have gained tremendous understanding and respect for the challenges facing educational leaders at the city, state and national levels. We have taken the lessons learned to restructure our professional development program to ensure that teachers get access to the content, best practices and ongoing support they need to be successful in the classroom. And today, T^3 is expanding to offer courses beyond math and science, as well as offering online, self-paced course delivery.

Universities

- As a participant with TETC, TI has made a $2 million donation to the Texas Workforce Development Grant Program in support of this effort.
- Multi-million dollar Digital Signal Processing University Research Fund—to seed development of future applications of digital signal processors
- TI Challenges—global university-level contests with up to $100,000 in prize money to promote and reward design of new products using state-of-the-art DSP and analog technologies
- University partnerships—where investments are made in numerous colleges and universities to improve electrical engineering programs, especially in the areas of digital signal processing and analog. Partner schools can be found in every major region of the world as well as 36 states in the U.S. including major nationally recognized engineering programs such as Georgia Tech, MIT, Stanford and University of Illinois. TI also has long-standing ties to top-notch Texas programs including Prairie View A&M, Rice, Texas A&M, Texas Tech and University of Texas at Dallas and University of Texas at El Paso
- Grants to provide new engineering building for the University of Houston System and Southern Methodist University, which will provide educational opportunities for students to work on the most advanced equipment and technologies
- Metroplex Research Consortium—a university partnership between Southern Methodist University, University of North Texas, University of Texas at Arlington and University of Texas at Dallas, providing research opportunities to more than 45,000 students in North Texas
- Support to more than 900 universities around the world with grants, equipment, expertise and scholarships
- TI supports SECME, a university-based partnership designed to increase the number of minority students prepared to enter and complete mathematics, science and technology studies
- Co-op and internship partnerships with community colleges and universities that help students gain work experience and provide needed financial support.

While these are all noteworthy endeavors, yet we at TI realize that it is not enough. As we enter an age of occupations increasingly driven by technological innovations it is imperative that we learn to partner with educational institutions on a **sustained basis** in the effort to give students the skills necessary to compete in a global economy.

BIOGRAPHY EZRA C. PENERMON

Ezra C. Penermon is Manager of Workforce Development at Texas Instruments in Dallas. As such, he works closely with secondary and post-secondary educational institutions on educational programs designed to prepare students for the technical workforce of the future. With over 19 years of experience in the semiconductor industry he has worked in a variety of technical positions and for the past four years

has served as the TI liaison to technical programs at community colleges and technical schools across the country. Ezra serves on several boards/committees including the Dallas WorkSource Workforce Committee, the Dallas Greater Chamber Workforce Taskforce, Employer Council for Workplace Preparation, Interlink, TSTC Foundation, and several Texas Tech Prep Consortiums. Mr. Penermon serves on various advisory committees at community colleges and high schools across the state of Texas. He holds a Bachelors Degree in Electronics/Management from Dallas Baptist University.

Texas Instruments Incorporated

TEXAS INSTRUMENTS

Ezra C. Penermon
Post Office Box 660199, MS 8683
Dallas, Texas 75266
(214) 480-2528

April 19, 2002

The Honorable Sherwood L. Boehlert
Chairman, Committee on Science
2320 Rayburn House Office Building
Washington, DC 20515

The Honorable Sherwood L. Boehlert,

This letter is to provide clarification that Texas Instruments Incorporated does not receive funding from the National Science Foundation, or any other Federal Government funding for education initiatives.

Sincerely,

Ezra C. Penermon
Manager, WorkForce Development
Texas Instruments

Mr. SMITH. Ms. Sterry.

STATEMENT OF ELISSA P. STERRY, DEPUTY MANAGER, PUBLIC AFFAIRS FOR EXXONMOBIL CORPORATION

Ms. STERRY. Research Subcommittee Chairman Smith, Ranking Member Johnson, on behalf of ExxonMobil corporation I would like to express our appreciation to each of you for the time and consideration you are giving to educating tomorrow's workforce.

I am Elissa Sterry, Deputy Manager of Public Affairs for ExxonMobil Corporation. I have a Master of Science in Engineering, and I have been with our company for over 20 years. A majority of this time was spent managing Chemical business operations. During part of my career, I served as the Vice President of our Ethylene Elastomers Business. My responsibilities included man-

aging a worldwide workforce. I know firsthand how important our employees and their skills are to operating a successful business in a global marketplace.

First, let me give you a quick synopsis of our business. We are the world's largest publicly traded petroleum and petrochemical company with operations in nearly 200 countries and territories on six continents. We have 98,000 employees around the world. Over 36,000 of those employees are based in the United States, that's 37 percent of our workforce. The majority [52 percent] of the U.S.-based workforce is located in Texas. Our worldwide headquarters are in Irving, Texas.

Our business is highly technical involving multi-billion dollar projects that progress over many years. Using the latest technology is important to the success of building and developing these types of operations.

As a result, a skilled and educated workforce is critical to the success of our organization. Fifty percent of our U.S. employees are as defined by the U.S. government in managerial and professional positions. Of these, the majority hold degrees in engineering, geoscience or computer science. Plant operators and technicians also require strong math skills, mechanical aptitude and appropriate technical training.

We primarily hire employees who work in their home country. Although mostly for development reasons, more than 3,500 employees are currently on assignments outside their home country. Of those employees, we have nearly 100 individuals employed in the U.S. on H–1B visas. The majority of these have advanced degrees in engineering and science.

ExxonMobil has the industry's strongest portfolio of proprietary technology and is committed to remaining the leading developer of world-class technologies that will provide a strong base for future development. To remain the industry technology leader, we must continuously identify and hire talented graduates holding degrees in science and technology from our top universities. Seventy-five percent of our new hires are from engineering, geoscience and computer science disciplines. Over 20 percent of these new employees will hold advanced degrees as well.

Clearly, our ability to attract and retain the best and brightest science and technology graduates is at op priority and we face a number of challenges in achieving this goal. Of most significant is the declining number of students choosing to pursue an education in engineering. Although we are encouraged by recent data from the Engineering Workforce Commission of the American Association of Engineering Societies that indicates U.S. students receiving Bachelor degrees in engineering have actually increased by two percent from 1999 to 2000. The longer-term trend, however, since 1986 has been a decline in engineering enrollments. Enrollments in graduate schools are even lower and have continued to decline even into 2000.

For university-bound students, we also provide funds for university and society engineering programs, and provide internships that give students a chance to see how they can apply their technical education and learn about the possibilities for an exciting career in their field of study. Globally in 2001, we provided 900 in-

ternships and co-op assignments to top students who gained practical experience while still in school. Half of these were in the United States, and of those 44 percent were awarded to women and 26 percent were awarded to minorities. We believe these programs have the greatest potential for attracting students to our industry who are pursuing science and technology degrees. Interns and co-op students are our best ambassadors on campus, telling other students of their experiences and spreading the word about the high-tech nature of the oil and gas industry. I am very pleased to say that I am a direct beneficiary of ExxonMobil's Engineering Co-op Program. My first experience in the workplace was with ExxonMobil, and I'm very happy to say that I've enjoyed a strong professional experience over my 20 years with ExxonMobil.

In order to ensure that the supply of engineering graduates continues to grow, it is vital that the math and science curriculum, and career opportunities in the engineering field, continue to be emphasized at all levels of education. It is also important that university engineering curriculum continues to teach the fundamental skills that are the building blocks of our core technologies.

One area that is encouraging is the growing numbers of women and under-represented minority groups that have been entering engineering programs. As reported by the Commission on Professionals in Science and Technology, from the fall of 1996 to 1998, enrollments of women increased by 10 percent, African Americans 7 percent, Hispanic Americans 6 percent, Native Americans, 10 percent, and Asian Americans increased 19 percent.

We must not lose sight, however, that women and minorities remain very under-represented in the engineering workforce. A major goal of our educational programs is to increase the participation of minorities and women in these fields. In fact, initiatives in this area are the most enduring of our educational programs. In 1882, the same year that he founded our predecessor company, john D. Rockefeller made the grant that established Spelman College in Atlanta. In 1944, we made one of the first grants to the United Negro College Fund and have supported it every year since—most recently with a $500,000 grant to improve the computing and telecommunications infrastructure of its member colleges. ExxonMobil supports a number of other organizations devoted to improving the professional education of minorities and women.

Additionally, we have established other programs specifically designed to assist promising minority students majoring in engineering, geoscience, and computer science such as our Minority Technical Scholars Program.

Besides direct financial aid for potential recruits, we support programs designed to improve the quality of science, technology, engineering and mathematics education at both college and pre-college levels. These programs take several forms. Awareness programs seek to acquaint students and teachers, counselors and parents with the exciting career opportunities available to those that successfully complete majors in the scientific, engineering and business disciplines and what must be done to prepare oneself to major in these subjects. Bridge programs provide students with supplemental educational experiences to help them succeed in college.

Faculty development programs help elementary and secondary teachers and college faculties become more effective instructors.

Although not directly connected to ExxonMobil's immediate recruiting objectives, these programs do contribute to the development of a highly skilled workforce. Therefore, they help not only our company but also the global competitiveness of our Nation as a whole.

ExxonMobil also encourages employees and retiree participation in education initiatives through volunteer involvement and matching gift programs. In one program alone, over 200 of our employees volunteered as Science Ambassadors in Houston.

Since 1962, the ExxonMobil Educational matching Gift Program has provided more than $250 million in gifts to higher education in the United States. The three-to-one matching gift programs is this country's most generous cash matching gift program for higher education.

Maintaining our leadership position also requires a commitment to training and developing our workforce. Each year ExxonMobil conducts more than 300 in-house technical courses for more than 7,000 employees. Annual expenditures for training in this area exceed $20 million. Significant time and money is also spent on training in other areas such as leadership, safe operations, environmental compliance and individual skill building. Plant operators and technicians receive extensive on-the-job training and participate in certification programs.

In closing, American citizens need more science and math skills to compete in today's advanced technological world. In our view, this requires a comprehensive approach, beginning with qualified educators, strong math and science programs at all levels of education, community presence and involvement with universities, support for student organizations and professional societies, and scholarships and internships for talented students. Engineering education is important to our company, our industry and countless other industries in order to continue to increase the economic growth of our prosperous society.

Again, I wish to thank the Subcommittee for this opportunity to share an overview of our workforce and our vision of how to improve undergraduate science, math, engineering and technological education. Toward this goal, we offer our assistance in any way possible to complete your work. I would be happy to answer any questions.

Thank you.

Mr. SMITH. Thank you.

[The statement of Ms. Sterry follows:]

PREPARED STATEMENT OF ELISSA P. STERRY

Science Committee Chairman Boehlert; Ranking Science Committee Member Hall; Research Subcommittee Chairman Smith; Ranking Member Johnson, and Members of the Subcommittee, on behalf of ExxonMobil Corporation I would like to express our appreciation to each of you for the time and consideration you are giving to educating tomorrow's workforce.

I am Elissa Sterry, Deputy Manager of Public Affairs for ExxonMobil Corporation. I have a Master of Science degree in Engineering and I have been with our company for over 20 years, a majority of this time was spent managing Chemical business operations. During part of my career, I served as Vice President of our Ethylene Elastomers Business. My responsibilities included managing a worldwide workforce.

I know first-hand how important our employees and their skills are to operating a successful business in a global marketplace.

ExxonMobil appreciates this opportunity to provide the Subcommittee with specific information on three topics. I'll begin with an overview of ExxonMobil's current workforce. Secondly, I'll outline our activities in recruiting our future employees and finally, I'll present information on the education programs that we support.

First, let me give you a quick synopsis of our business. We are the world's largest publicly traded petroleum and petrochemical company with operations in nearly 200 countries and territories on six continents. We have 98,000 employees around the world. Over 36,500 (37 percent) of these employees are based in the United States. The majority (52 percent) of the U.S.-based workforce is located in Texas. Our worldwide headquarters are in Irving, Texas.

Our business is highly technical involving multi-billion dollar projects that progress over many years. Using the latest technology is important to the success of building and developing these types of operations.

As a result, a skilled and educated workforce is critical to the success of our organization. Fifty percent of our U.S. employees are as defined by the U.S. government in managerial and professional positions. Of these, the majority holds degrees in engineering, geoscience or computer science. Plant operators and technicians also require strong math skills, mechanical aptitude and appropriate technical training.

We primarily hire employees to work in their home country. Although mostly for development reasons, more than 3,500 employees are currently on assignments outside their home country. Of those employees, we have nearly 100 individuals employed in the U.S. on H–1B visas. The majority of these have advanced degrees in engineering and science.

Given the long-term nature of our business, we don't underestimate the value of a stable workforce. Our U.S. employees average just over 16 years of service. Whether we are recruiting or developing a long-term employee, we believe the opportunity for continuous education and development is essential.

ExxonMobil has the industry's strongest portfolio of proprietary technology and is committed to remaining the leading developer of world-class technologies that will provide a strong base for future development. To remain the industry technology leader, we must continuously identify and hire talented graduates holding degrees in science and technology from our top universities. Seventy-five percent of our new hires are from engineering, geoscience and computer science disciplines. Over 20 percent of these new employees will hold advanced degrees.

Clearly, our ability to attract and retain the best and brightest science and technology graduates is a top priority and we face a number of challenges in achieving this goal. Of most significance is the declining number of students choosing to pursue an education in engineering. Although we are encouraged by recent data from the Engineering Workforce Commission of the American Association of Engineering Societies that indicates U.S. students receiving bachelor degrees in engineering have actually increased by two percent (2000 versus 1999), the longer term trend since 1986 has been a decline in engineering enrollments. Enrollments in graduate schools are even lower and have continued to decline even into 2000.

Our challenge in this area becomes even greater when it is coupled with the competition for qualified technical talent, which continues to increase at a rapid pace. For example, emerging technologies such as bioengineering and robotics have expanded the career choices of engineers. Even non-traditional companies such as consulting firms and Wall Street have discovered the benefits of applying an engineering education in the businesses. Opportunities for engineers have never been greater. We therefore, cannot let up in our efforts to help increase the technology employment pool.

To address this challenge, ExxonMobil, commits substantial resources both in terms of employee time and money on initiatives to encourage and attract students seeking degrees in engineering and science disciplines. We have a highly active, coordinated university recruiting program where a volunteer army of our best technologists regularly visit with students on campus to open their minds to the technical challenges that must be overcome if we are to meet the energy demands of a world economy. We fund university research projects in order to leverage our technology development and expose students to exploration, production and process technology.

For university-bound students, we also provide funds for university and society engineering programs, and provide internships that give students a chance to see how they can apply their technical education and learn about the possibilities for an exciting career in their field of study. Globally in 2001, we provided 900 internships and co-op assignments to top students who gained practical experience while still in school. Half of these were in the United States, and of those, 44 percent were

awarded to women and 26 percent were awarded to minorities. We believe these programs have the greatest potential for attracting students to our industry who are pursuing science and technology degrees. Interns and co-op students are our best ambassadors on campus telling other students of their experiences and spreading the word about the high-tech nature of the oil and gas industry.

In order to ensure that the supply of engineering graduates continues to grow, it is vital that the math and science curriculum, and career opportunities in the engineering field, continue to be emphasized at all levels of education. It is also important that university engineering curriculum continues to teach the fundamental skills that are the building blocks for our core technologies.

One area that is encouraging is the growing numbers of women and under-represented minority groups that have been entering engineering programs. As reported by the Commission on Professionals in Science and Technology, from the fall of 1996 to 1998, enrollments of women increased by 10 percent, African Americans 7 percent, Hispanic Americans 6 percent, Native Americans 10 percent, and Asian Americans, increased 19 percent.

We must not lose sight, however, that women and minorities remain very under-represented in the engineering workforce. Although African Americans, Hispanic Americans, and Native Americans now comprise 25 percent of the U.S. population; they comprise only 12 percent of the baccalaureates awarded in engineering in 2000, and women who make up almost 50 percent of the population account for only 20 percent of the undergraduate engineering degrees. A major goal of our educational programs is to increase the participation of minorities and women in these fields. In fact, initiatives in this area are the most enduring of our educational programs. In the year (1882) that he founded our predecessor company, John D. Rockefeller made the grant that established Spelman College in Atlanta. In 1944 we made one of the first grants to the United Negro College Fund and have supported it every year since—most recently with a $500,000 grant to improve the computing and telecommunications infrastructure of its member colleges. ExxonMobil supports a number of other organizations devoted to improving the professional education of minorities and women, including:

- National Action Council for Minorities in Engineering—an organization that gives college scholarships to minority students interested in engineering.
- SECME, a minority engineering outreach organization—outreach targeted at minority students at the K–12 level that recruits and prepares students for advanced training in engineering and related fields.
- Society of Women Engineers—an organization with a goal to attract women to mathematics and technical and engineering professions.
- Association for Women in Mathematics—an association that recruits women to major in mathematics and has programs devoted to retaining women who are already specializing in this field.
- National Society of Black Engineers—a professional organization that supports students through scholarships and campus events.
- Society of Hispanic Professional Engineers—a group that promotes the engineering profession among Hispanics.

Additionally, we have established other programs specifically designed to assist promising minority students majoring in engineering, geoscience, and computer science such as our Minority Technical Scholars Program.

The Minority Technical Scholars Program was established in 1990 with the objective to provide internships and assistance to attract top minority technical candidates. Design of the program was based on the Exxon Minority Fellows program established in 1966 to provide financial assistance to high achieving minority students pursuing Master's degrees in Business Administration (MBA). Most scholars are identified after their sophomore year in college. Financial assistance is designed to subsidize college cost (tuition, living expenses, books and lab fees). To maintain the scholarship, the students must maintain a 3.0/4.0 each semester, and make expeditious progress towards completion of their technical degree.

Besides direct financial aid for potential recruits, we support programs designed to improve the quality of science, technology, engineering and mathematics education at both college and pre-college levels. These programs take several forms. Awareness programs seek to acquaint students and teachers, counselors and parents with the exciting career opportunities available to those that successfully complete majors in the scientific, engineering and business disciplines and what must be done to prepare oneself to major in these subjects.

Bridge programs provide students with supplemental educational experiences to help them succeed in college. Faculty development programs help elementary and secondary teachers and college faculties become more effective instructors.

Although not directly connected to ExxonMobil's immediate recruiting objectives, these programs do contribute to the development of a highly skilled work force. Therefore they help not only our company but also the global competitiveness of the nation as a whole. Our interests, however, go well beyond increasing the supply of technology workers. More and more of the decisions of daily life have scientific, technological and mathematical dimensions. Therefore, one of our objectives is to create more science savvy citizens—members of our society who can make better informed choices about all of their activities.

Because of its long-term commitment, the ExxonMobil Foundation has played a significant role in this country's education reform movement. Some examples of programs ExxonMobil supports include:

- Project NExT which is administered by the Mathematics Association of America, helps prepare new Ph.D. mathematicians for the challenges of undergraduate teaching. This program has benefited more than 600 beginning faculty at 400 educational institutions.
- Project Kaleidoscope's Faculty for the 21st Century focuses on leadership development. It identifies promising undergraduate science faculty members who are approaching tenure and brings them together with faculty mentors who are involved in educational reforms. More than 1,000 faculty members from 400 institutions have participated in the program.
- Departmental Grants are provided to the 100 universities where ExxonMobil seeks to recruit employees. Through this program $1.9 million in unrestricted grants are provided annually directly to academic departments.
- The ExxonMobil K–5 Mathematics Specialists Program works to strengthen elementary school math education. Since 1988, ExxonMobil has awarded mathematics specialist grants to 115 school districts across the United States, including Houston, Texas where we have a very active presence.
- The National Science Teachers Association's Building A Presence for Science program that is active in 20 states. In addition to providing a better understanding of national and state science education standards, this program helps create a network that science teachers can use to share the latest ideas about teaching science more effectively. In Texas, which joined the program in 1996, more than 7,600 K–12 schools are participating.
- The 2002 ExxonMobil Texas Science and Engineering Fair for middle and high school students. The Fair held this month in Arlington, Texas had over 900 students participating.
- The Rising Star Scholarship Program awards scholarships to graduates of high schools in Dallas County to attend the Dallas County community college district.
- The Math/Science Partnership Program, recently created as part of the "No Child Left Behind" Act, brings local school districts, college math, science, or engineering schools, and other groups including businesses together to improve K–12 math and science education.

ExxonMobil also encourages employee and retiree participation in education initiatives through volunteer involvement and matching gift programs. In one program alone, over 200 of our employees volunteered as Science Ambassadors in Houston.

Since 1962, the ExxonMobil Educational Matching Gift Program has provided more than $250 million in gifts to higher education in the United States. The three-to-one matching gift program is this country's most generous cash matching gift program for higher education.

To increase awareness of engineering career opportunities, ExxonMobil is a long-term supporter of "Engineers Week," sponsored by the National Society of Professional Engineers. In addition, ExxonMobil has placed editorials in major newspapers to explain the importance of the engineering profession, available career opportunities, and the shortage of qualified engineers that exists. In 2001, the American Society of Engineering Educators presented their President's Award to ExxonMobil for these communication efforts.

Maintaining our leadership position also requires a commitment to training and developing our workforce. Each year ExxonMobil conducts more than 300 in-house technical courses for more than 7,000 employees. Annual expenditures for training in this area exceed $20 million. Significant time and money is also spent on training in other areas such as leadership, safe operations, environmental compliance and

individual skill building. Plant operators and technicians receive extensive on-the-job training and participate in certification programs.

Development of future technical and managerial leaders is also a critical focus area. We strive to provide our employees the opportunity for continued growth and development over the span of their career. Employees and supervisors share the responsibility for identifying training needs and ensuring that all employees develop to their full potential.

In closing, American citizens need more science and math skills to compete in today's advanced technological world. In our view, this requires a comprehensive approach beginning with qualified educators, strong math and science programs at all levels of education, community presence and involvement with universities, support for student organizations and professional societies, and scholarships and internships for talented students. Engineering education is important to our company, our industry and countless other industries in order to continue to increase the economic growth of our prosperous society.

Again, I wish to thank the Subcommittee for this opportunity to share an overview of our workforce and our vision of how to improve undergraduate science, math, engineering and technology education. Toward this goal, we offer our assistance in any way possible to complete your work. I would be happy to answer any questions.

BIOGRAPHY FOR ELISSA P. STERRY

Elissa Sterry graduated from Cornell University in 1981, with a Master of Science degree in Engineering. The same year, she started her career with Exxon Chemical Company in information management, located in Houston.

In 1985, when a new marketing organization was formed, Elissa moved into sales and marketing for the Health Care industry sector. Based in Chicago, IL, she held sales and senior market development positions.

She moved to Exxon Chemical Company headquarters located in Darien, CT in 1989, to take up the responsibility of Advisor to the Polymers Business President, Exxon Chemical Company.

In 1991, she was promoted to a managerial position at the Polyethylene production facilities in Mount Belvieu. Two years later, she became marketing manager for the Adhesion Business Unit, Americas, based in Houston, TX.

In 1996, Elissa was appointed to the position of General Manager for the Polymers Applications Business Unit, based in Lake Zurich, IL.

She was promoted to Vice President in 1999, in charge of the worldwide Ethylene Elastomers Business, and relocated to the worldwide ExxonMobil Chemical headquarters in Houston. In her role, she was responsible for the worldwide manufacturing, sales, marketing and technology organizations. She also serves on the board of directors for several of ExxonMobil Chemical's joint ventures.

In 2002, she was named Deputy Manager of Public Affairs at ExxonMobil Corporation and her responsibilities include coordination of worldwide communication efforts.

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Elissa P. Sterry
Deputy Manager
Public Affairs

ExxonMobil

April 22, 2002

The Honorable Nick Smith
Chairman
Subcommittee on Research
U.S. House of Representatives
Committee on Science
Suite 2320
Rayburn House Office Building
Washington, DC 20515

Dear Representative Smith:

Although Exxon Mobil Corporation, its divisions and affiliates have numerous contracts with departments of the U.S. Government, we have not accepted Federal Government funding to prepare our 21st century workforce or in support of our grants to strengthen and improve Science, Math and Engineering education.

Sincerely,

Elissa P. Sterry

EPS:la

Mr. SMITH. Mr. Norman Robbins of Lockheed Martin.

STATEMENT OF NORMAN B. ROBBINS, COMMUNITY RELATIONS MANAGER FOR LOCKHEED MARTIN

Mr. ROBBINS. Chairman Smith, Congresswoman Johnson, I am Norman Robbins, Community Relations manager at Lockheed Martin Aeronautics Company. In this position, I am responsible for the Aeronautics Company's civic involvement programs.

Much of our civic involvement is directed at educational initiatives with a particular focus on math, science and engineering. The reason should be self-evident. Lockheed Martin is, above all else, a technology company. We are a satellite and missile company, a military aircraft company, an electronics company and an information technology company.

We employ more than 60,000 scientists and engineers and write more lines of software code than Microsoft. Our concern, like those

of this Committee, is to increase the number of students in math, science and engineering.

Over the past several years, Lockheed Martin has been deeply involved in the effort to introduce standards, measurement and accountability in our Nation's schools, kindergarten through the 12th grade. We believe that what gets measured gets improved. We were pleased and supportive of the direction that Congress and the Administration took with the recent passage of the Education Act.

Demographic factors are directly affecting our corporation's need for technical talent. At present, there is a shrinking pool of experienced aerospace workers, which has declined 42 percent over a recent 10-year period. Industry consolidation has left the aerospace industry with a mature workforce with 63 percent over the age of 40.

We find ourselves in need of replenishing our technical workforce at the same time that the supply of such talent is declining. Engineering enrollments are down while job growth for engineers is expected to double. This trend is even more troublesome for companies like ours, which are unable to hire non-U.S. citizens.

Labor force diversity trends directly impact our ability to obtain needed talent. Minority groups make up the fastest growing segment of the U.S. labor force and will soon comprise nearly a third of the total. Outreach programs that encourage minorities and females to enter engineering is having a positive impact, but growth has leveled off in recent years. Such a trend compounds our ability to hire nearly 90,000 people over the next years, of which 53,500 need technical backgrounds.

But what about the necessity of "priming the pump" for future labor force needs? As an advanced technology company, we recognize that excellence in education and educational opportunities for all are the best guarantees of a strong and competitive America in the future.

With that in mind, Lockheed Martin gives more than half of its $18 million in philanthropy a year to support a variety of educational programs and initiatives. About 60 percent of our total contributions are to education in such areas as computer technology, engineering programs, and to programs supporting minorities and women in these disciplines. In 2000, Lockheed Martin pledged $1 million to the United Negro College Fund to support efforts to eliminate the digital divide among minority college students.

Recognizing that educational excellence must start at the beginning, Lockheed Martin educational initiatives also are devoted to strengthening students' capabilities from kindergarten through grade 12 in math, science and technology. Indicative of this commitment at the grassroots level is *In-Unity,* a program where volunteers, many of them Missiles and Fire Control employees, tutor math and science to at-risk second-and third-grade students at Fannie C. Harris Elementary School in Dallas. When *In-Unity* started in 1988, the children had scored last in math and reading among all K–3 students in the Dallas Independent School District. Today, they rank at the top, prompting a President's Service Award.

Lockheed Martin is a long-time contributor to the Girl Scouts. Our recent five-year commitment of $500,000 makes Lockheed Martin one of the first sponsors of an initiative to bridge the gender divide in technology, science and computer literacy.

Bringing excitement and wonder to math and science education is the goal behind Space Day, an annual celebration dedicated to the extraordinary achievements, benefits and opportunities in the exploration and use of space. Lockheed Martin is the founding sponsor.

In Ft. Worth, the Aeronautics Company has established a Hands On Science learning lab in partnership with the Ft. Worth Museum of Science and history, ExxonMobil and Texas Christian University's School of Education. The learning lab stimulates the natural curiosity of children to learn math and science through hands-on activities while local teachers can learn and improve effective teaching techniques.

The need for these types of programs is evident. The National Assessment of Educational Progress found that fewer than one-third of all U.S. students in grades 4, 8, and 12 performed at or above the "proficient" achievement level in math and science. To further compound this problem, current research shows that U.S. students are losing interest in science and math as early as the third grade. Many adults are scientifically illiterate and as many as 40 percent of K–12 teachers do not feel prepared to teach math or science.

As with any effort, resource restrictions frequently limit the amount and quality of programs and projects addressing math, science and engineering education. We could all do more and perform better with additional resources.

Congressional funding provided to traditional and non-traditional educational sources will help address the shortfall in technical talent, which will likely remain for some time to come. We simply must continue to address, and at a faster rate, the shortage of students pursuing math, science and engineering in order to be competitive in the future. Lockheed Martin looks forward to working with you and others to address this most pressing need.

Thank you for the opportunity to be with you today.

Mr. SMITH. Thank you.

[The statement of Mr. Robbins follows:]

PREPARED STATEMENT OF NORMAN B. ROBBINS

Chairman Smith and Members of Congress, I am Norman Robbins, Community Relations Manager at Lockheed Martin Aeronautics Company. In this position, I am responsible for the Aeronautics Company's civic involvement programs, which place company assets (financial, material and people) in civic activities to accomplish programs and projects of value to the community and to our company.

Much of our civic involvement is directed at educational initiatives with a particular focus on math, science and engineering. The reason should be self-evident. Lockheed Martin is, above all else, a technology company. We are a satellite and missile company, a military aircraft company, an electronics company and an information technology company.

We employee more than 60,000 scientists and engineers and write more lines of software code than Microsoft. Our concern, like those of this Committee, is to increase the number of students in math, science and engineering.

Over the past several years, Lockheed Martin has been deeply involved in the effort to introduce standards, measurement and accountability in our nation's schools, kindergarten through the 12th grade. We believe that what gets measured gets im-

proved. We were pleased and supportive of the direction that Congress and the Administration took with the recent passage of the Education Act.

When it comes to policies affecting math, science and engineering education, we are deeply involved at all levels national, state and local. Our Board Chairman, Dr. Vance Coffman, has had a leadership role in the Business Roundtable for Education and its subcommittee, the Business Coalition for Excellence in Education.

Since our Corporation is based in Maryland, we co-founded the Maryland Business Roundtable for Education. In addition, local operating companies are encouraged to be supportive of statewide initiatives in their respective areas, and in Texas, we support the Texas Business and Education Coalition.

Demographic factors are directly affecting our corporation's need for technical talent. At present, there is a shrinking pool of experienced aerospace workers, which has declined 42 percent over a recent 10-year period. Industry consolidation has left the aerospace industry with a mature workforce with 63 percent over the age of 40.

We find ourselves in need of replenishing our technical workforce at the same time that the supply of such talent is declining. Engineering enrollments are down while job growth for engineers is expected to double. This trend is even more troublesome for companies like ours, which are unable to hire non-U.S. citizens.

Labor force diversity trends directly impact our ability to obtain needed talent. Minority groups make up the fastest growing segment of the U.S. labor force and will soon comprise nearly a third of the total. Outreach programs that encourage minorities and females to enter engineering is having a positive impact, but growth has leveled off in recent years. Such a trend compounds our ability to hire nearly 90,000 people over the next several years, of which 53,500 need technical backgrounds. Our hiring goals include substantial numbers of college graduates to positively address our aging labor force and a substantial number of minorities and females to complement labor force trends and to add value to our company.

To be successful, Lockheed Martin must be recognized as a corporation that values all employees. Aggressive recruitment and leadership are required to develop a diverse workforce. We are pursuing new talent as quickly as possible, and we are working to provide career advancement opportunities for our employees.

But what about the necessity of "priming the pump" for future labor force needs? As an advanced technology company, we recognize that excellence in education and educational opportunities for all are the best guarantees of a strong and competitive America in the future.

With that in mind, Lockheed Martin gives more than half of its $18 million in philanthropy a year to support a variety of educational programs and initiatives. About 60 percent of our total contributions are to education in such areas as computer technology and engineering programs, and to programs supporting minorities and women in these disciplines. In 2000, Lockheed Martin pledged $1 million to the United Negro College Fund to support efforts to eliminate the digital divide among minority college students.

Lockheed Martin makes grants to colleges and universities that have nationally recognized programs in science, engineering and computer science. Grants to colleges and universities also are made through the employee Matching Gift Program. Among the universities we support are The University System of Maryland Applied Information and Technology Initiative, Penn State; and the Lockheed Martin Software Learning Center at MIT, a modern classroom for the application of technology for engineering disciplines and computer science.

Recognizing that educational excellence must start at the beginning, Lockheed Martin educational initiatives also are devoted to strengthening students' capabilities from kindergarten through grade 12 in math, science and technology.

Indicative of this commitment at the grassroots level is *In-Unity*, a program where volunteers, many of them Missiles and Fire Control employees, tutor math and science to at-risk second and third-grade students at Fannie C. Harris Elementary School in Dallas. When *In-Unity* started in 1988, the children had scored last in math and reading among all K–3 students in the Dallas Independent School District. Today, they rank at the top, prompting a President's Service Award.

Lockheed Martin is a longtime contributor to the Girl Scouts. Our recent five-year commitment of $500,000 makes Lockheed Martin one of the first sponsors of an initiative to bridge the gender divide in technology, science and computer literacy. Another Lockheed Martin-funded program, *Girls of the Center*, introduces basic science principles to Girl Scouts in councils nationwide through mentoring programs. At the local level, Aeronautics Company engineers involve Girl Scouts in a computerized wing-design program to stimulate their problem-solving abilities.

Bringing excitement and wonder to math and science education is the goal behind *Space Day*, an annual celebration dedicated to the extraordinary achievements, benefits and opportunities in the exploration and use of space. Lockheed Martin is the

founding sponsor. Since its inception in 1997, Space Day has focused directly on the advancement of science, math and technology education. Space Day has more than 70 partners, including major education organizations such as the National Science Teachers Association, the National Association of Elementary School Principals and the National Council of Teachers of Mathematics. In classrooms across the country, Space Day is centered around programs for upper-grade elementary students developed by the Challenger Center for Space Science Education.

Other major components of Space Day are Student Signatures in Space, a unique program for lower-grade elementary students in which students sign posters that are digitized and sent into space on a shuttle mission, and a live web cast on Space Day that includes interviews with scientists, astronauts and space experts.

Our Space Operations Company in Houston is actively involved in the Mathematics/Science Pedagogy Institute, working to relate to teachers in the Houston area how the concepts they teach are used in the aerospace industry.

In Fort Worth, the Aeronautics Company has established a Hands On Science learning lab in partnership with the Fort Worth Museum of Science and History and Texas Christian University's School of Education. The learning lab stimulates the natural curiosity of children to learn about math and science through hands-on activities while local teachers can learn about and improve effective teaching techniques.

Lockheed Martin and other employers throughout the country undertake many other math, science and engineering oriented programs and projects. In the aggregate, these activities impact substantial numbers of students throughout the Nation.

The need for these types of programs is evident. The National Assessment of Educational Progress found that fewer than one-third of all U.S. students in grades 4, 8 and 12 performed at or above the "proficient" achievement level in math and science. To further compound the problem, current research shows that U.S. students are losing interest in science and math as early as the third grade. Many adults are scientifically illiterate and many (40 percent) K–12 teachers do not feel prepared to teach math or science.

In order to stimulate our ability to interest more students in math, science and engineering, we must show them why it is important for them to have these skills, and we must involve them in active learning where they are allowed to problem-solve using these skills. We must also provide teachers with the ability to actively engage students in the learning process.

As with any effort, resource restrictions frequently limit the amount and quality of programs and projects addressing math, science and engineering education. We could all do more and perform better with additional resources.

Congressional funding provided to traditional and nontraditional (for example, museums) educational sources will help address the shortfall in technical talent, which will likely remain for some time to come. We simply must continue to address—and at a faster rate—the shortage of students pursuing math, science and engineering in order to be competitive in the future. Lockheed Martin looks forward to working with you and others to address this most pressing need.

Thank you for the opportunity to be with you today.

BIOGRAPHY FOR NORMAN B. ROBBINS

Norman Robbins joined Lockheed Martin in 1986 as Manager of Community Relations. In that capacity, he oversees and administers the company's Community Involvement Program, which consists of strategically placing company resources (people, financial and material) in community activities to accomplish objectives of value to the community and the company.

Mr. Robbins' work includes many civic involvements. Among positions that he has held are memberships on boards and committees including TCU's School of Education Board of Visitors, the Fort Worth ISD's School & Community Partnerships Advisory Committee, Tarrant County Workforce Development Board, Big Brothers and Sisters of Tarrant County, Fort Worth Chamber Aviation Committee, Greater Fort Worth Literacy Council, and Communities in Schools.

Prior to joining Lockheed Martin, Mr. Robbins was employed by the Fort Worth Chamber of Commerce in a variety of capacities which included economic development and governmental/urban affairs types of activities. Before joining the Chamber, he was employed in the international air freight forwarding industry, having written a thesis on the air freight industry in Dallas/Fort Worth.

Mr. Robbins holds Bachelor and Master of Science degrees in Business Administration from Trinity University in San Antonio. A native of Fort Worth, he is married with three grown children.

Lockheed Martin Aeronautics Company
PO Box 748 Fort Worth, TX 76101

LOCKHEED MARTIN

April 19, 2002

The Honorable Sherwood L Boehlert
Chairman
Committee on Science
U. S. House of Representatives
2246 Rayburn House Office Building
Independence Ave. & S. Capitol St., SW
Washington, D. C. 20515

Dear Chairman Boehlert:

In accordance with the Rules of the House of Representatives, please be advised that Lockheed Martin receives revenue from the Departments of Defense and Energy, National Aeronautics and Space Administration and other federal sources. This financial disclosure is being made in accordance with my appearance before the Science Committee's Subcommittee on Research.

Very truly yours,

Norman B. Robbins, Jr.
Manager – Community Relations

DISCUSSION

Mr. SMITH. We'll start with our Vice Chairman, Ranking Member, Eddie Bernice Johnson, and, Congresswoman Johnson, how long should we go on questions and go back and forth, seven minutes or so?

Ms. JOHNSON. That's fine. How many rounds should we take?

Mr. SMITH. Ten, or 12, or until we run out of energy.

Ms. JOHNSON. My grandchildren came in up there.

Mr. SMITH. Okay, we better introduce that fine looking group up there.

Ms. JOHNSON. Well, let me see, I had a brother-in-law that was—today, so my son and his family came to the funeral, I skipped it because of this. They are right up there. Kirk Johnson, Kirk II, David and James, and their mother, Sondra. James was destined to be a girl but he didn't come out that way. He's quite a boy.

The Dallas Independent School District budget really dwarfs the amount that the National Science Foundation puts into Urban Sys-

temic Initiative Awards, and I'm wondering how important is that program? I mean, you've got a humongous budget for the Dallas Independent Schools.

Ms. WEST. Congresswoman Johnson, you are correct, we have a huge budget in the Dallas ISD, and when you compare that with the funding that we have received from the National Science Foundation it really dwarfs it, but what we need more than anything from the NSF is the oversight, the guidelines, the monitoring, and the suggestions that we get over time.

We are in Dallas, but the NSF has access to lots of information from across the Nation and we value that information.

So, we look forward to many, many years of doing business and working with the NSF.

Ms. JOHNSON. Can you tell us the difference that that program has made?

Ms. WEST. Well, yes, in terms of what the NSF has done for the Dallas ISD, I think we have to go back to 1994, when we received the first grant. At that time, I was, I believe, a Secondary Specialist. We were all so very excited about getting the grant, because those especially of us who were involved mathematics, science and technology saw it as a way of really answering many of the questions that I've heard in terms of getting qualified persons for the next generation.

So, we welcomed the oversight and the information. It made a lot of people more aware of the needs. It brought partnerships to the table, many that have worked with us over time. And, when you look at the amount of monies that were given by NSF, the first grant in 1994 was a five-year grant for $15 million, so you are talking about $3 million per year, and the last grant that we got in 1999 was $11.6 million. So, you know, with a student population of 164,000, almost 11,000 teachers in the DISD, it's easy to say that we want more than the money. We want the money, but also the continued oversight, the directions that we receive. That is very important to us.

Ms. JOHNSON. Can you tell a difference in whether or not there are more students interested or proficient in the areas of math and science?

Ms. WEST. Yes, absolutely. In terms of our AP courses, we have more students enrolled in the Advanced Placement courses, more minority students, and more students just in general.

Ninety-one percent of our students are minority, so we are just ever so happy to have all students enrolled in mathematics, science and technology.

We also have more elementary schools that have a focus on science. We have more schools that are going to departmentalized at the elementary level, from 4th through 6th, as opposed to many years of self-contained classes. We have magnet schools that integrate lots of mathematics and science courses, so we can see also in our improved test scores even this year.

So, we are getting where we need to be.

Ms. JOHNSON. Thank you.

Dr. Orsak, you head up The Infinity Program at SMU, and one of its goals is to attract more students in those areas. How do you gauge, how you grade your success in tracking students?

Dr. ORSAK. Well, I think, to be a little bit modest, I think we've done an exceptional job, not so much because of us and what we've done, it's because of the children. You know, they've struggled to find anything in math and science education that was really relevant to their lives, and then we come along and give them an opportunity to engage in the future, and they just jump on it.

And so, we see, as I said in my prepared statement, that nationally only 2 percent of the kids in high school graduating classes will ever go on to get an engineering or technology degree, yet we are seeing 65 percent of our students wanting to pursue those. So, that's a 30 times benefit for this program.

And really, I think it's because of the era more than it is because of our specific program. I mean, this is the era where kids are walking around with cell phones and going to movies where there's a lot of special effects and technology. You just haven't seen that translated into education at all. And so, our program really allows them to connect with that, and that's what makes it so popular.

Ms. JOHNSON. Do you relate to high school students, or elementary school students?

Dr. ORSAK. Our program is primarily focused at high school students, but it's been so successful that universities have adopted it now as their freshman course. And again, I think it's really a testament to the high-quality people that are involved with our program and the level of input and involvement we've got from Texas Instruments that's really made it so nationally successful.

Ms. JOHNSON. Do you have any relationship with the Science Place or what schools do you work with?

Dr. ORSAK. Well, we don't have a specific relationship with Science Place today. We would like to, and they've asked us to help them bring some kind of high tech engineering into their portfolio. But, we work very closely with the ISD, we have 14 schools, actually, we will have 14 schools in DISD this year.

Interestingly enough, we also have some very high end private schools in our program here in the community. This stuff works for all kids, and all demographics and ethnic backgrounds. I mean, it's just fun for them, it doesn't matter who you are, I mean, some stuff is just fundamentally fun, and we try to make sure kids are exposed to that.

Ms. JOHNSON. Is my time up?

Ms. STERRY. You have 20, 19, 18, 17——

Ms. JOHNSON. Let me ask one more question then.

Mr. Robbins from Lockheed Martin, you indicated that you help a lot in education and I know the companies do contribute. Do you just contribute in schools just around Ft. Worth or do you go beyond that?

Mr. ROBBINS. We are focused primarily on Tarren County, and most of the students that we try to impact are in Tarren County. However, we have employees that live all over north Texas, and frequently we'll support their individual interests in the schools where their children attend.

On my way over here today, I had two calls for Career Day Opportunities, one of whom was an employee that wants to go to their child's school and another was a school contacting us to see if we could find somebody in a specific career field to attend that school.

But, we are, Congresswoman Johnson, focused primarily on Tarren County. We do a number of things there. We are not able to do as much as we would like there, and again resource restrictions are the primary driver.

Ms. JOHNSON. Thank you.

ExxonMobil, I know that you have contributed as well, how do you make a determination when contributing?

Ms. STERRY. Well, ExxonMobil, as I mentioned in my prepared testimony, as you know is a global company, and we have many demands upon our company for our money and for our influence.

In the United States, we have 36,000 employees, the majority of those are based in the Houston, Dayton and Bowman areas, and so we did put a specific emphasis on that environment and that general area.

In the Dallas area we have fewer employees, some 400, but we do focus on several specific activities in Dallas as well. In Dallas, we recently sponsored the ExxonMobil Texas State Science and Engineering Fair, it was very well attended with over 900 middle and high school students who participated.

We also have Rank and Star Scholarship Program in the Dallas area, and this awards scholarships to graduates of high schools in Dallas to attend Dallas County Community College, and acts as a bridge preparing them for their college after that.

So, we do actually participate in the Dallas community, as well as other communities where we have operations. ExxonMobil is the largest corporate contributing to SECI, which is a minority outreach organization that targets——

Ms. JOHNSON. What was that name?

Ms. STERRY.—SECI, which targets students K–12, this is an organization that has a broad reach as far as north as Syracuse, New York, and as far west as Arizona, and there the primary focus is to prepare students for advanced training in human-related fields.

So, I think that you can see that as it models our operations to try and work where we have operations, but then also extend our reach as far as the entire country, and also as far as the entire world.

Ms. JOHNSON. Thank you very much. Do you only recruit in those areas where you have your locations?

Ms. STERRY. No, we recruit very broadly, from a broad range of universities, in order to attract the kind of technical talent that I described. We really look, literally, at the top universities in the United States and also outside the United States to attract the very best talent we can find.

Ms. JOHNSON. Thank you very much. My time is up.

Mr. SMITH. In passing the "No Child Left Behind" partnership program of H.R. 1858, we have witnesses testifying, and one of my questions was to the extent that elementary education is more the lighting of a fire than the filling of a container of knowledge, when is that fire started, when is that fire lit, when does that excitement or interest in science and math start?

And, three of the witnesses said that probably in the 1st, 2nd or 3rd grade, and another witness said, well, it probably has to start at home before they go to school. I mean, if they go a parent and somehow the parents say, well, I didn't do well in math and science

and it didn't hurt me, probably that's a beginning of putting out a fire, at least not kindling that fire.

So, if the fire starts there, that interest, and then to rekindle that interest in science and math through K–12, you've got to somehow have quality teachers that understand the interest of science and math, and another interesting aspect is they all said science and math has to be fun, it has to be interesting. And, even in higher education, when you get into college, that was their answer, it has to be fund, it has to be interesting, it has to be challenging.

But, especially in K–12, maybe we are falling down on the information of the careers and the kind of financial rewards and demand for those careers. And so, I want to ask a question about the H–1B program, the immigration program where we allow more engineering students in from other countries, rather than paying our engineers more money that would probably send out a better signal for demand.

Would the three industry spokesmen react to that?

Mr. ROBBINS. We are unable to take advantage of hiring non-U.S. citizens, so we are—that drives our need for U.S. talent higher than maybe some other employers.

The nature of our business does not lend itself to having non-U.S. citizens in our employ, so that's one of the reasons why we were so focused on trying different things within the United States, you know, that could be offering the company something that's very heavily engaged in math, science and technical careers.

Mr. SMITH. And, Ms. Sterry, ExxonMobil, of course, hires a lot of these individuals, to what extent is it going to diminish the message of the high demand that we have for American students in these careers?

Ms. STERRY. Congressman Smith, as I mentioned, we have 98,000 employees worldwide. Today we have 100 individuals who are in the United States on Asian visas. These individuals are typically here in order to gain important development skills before returning to their home country.

We still have, as I mentioned, approximately 37 percent of our workforce in the U.S. where our need for technical talent continues to remain very high, and where we work actively to try and encourage our local workforce into technical and science fields.

Mr. SMITH. Mr. Penermon, let me expand that question to you, to also to relate to what I see as a problem in industry, as industry, in effect, I'm a farmer, so lack of a better expression, "eating our seed corn," hiring not only students as soon as they graduate, but also hiring professors and taking them out of the universities that are the key to stimulating good students.

Any reaction?

Mr. PENERMON. Chairman Smith, that is a very good observation. It's sort of the nature of the beast. When you need technical workers, and we all are here today because we know that there is a need, it forces companies like TI and others to look for the talent wherever we can find it.

We would not like to see our educators being robbed from that position to fill our needs, and your point about the need to ignite a fire early on is very well taken. I believe that the technology that

we are wrestling with, in terms of technical innovations and how to sustain and maintain those technical innovations, may, indeed, be the very tool that we can use to help light that fire, in terms of showing students, teachers, parents, etcetera, what the technology-driven workplace is all about, and getting that technology into the hands of the folks who are entrusted with that challenge.

Mr. SMITH. What percentage—who said, of the young students that start in college in science and math, what percentage are going to graduate in science and math? Somebody gave me that statistics.

Dr. SMATRESK. Less than 50 percent.

Mr. SMITH. Less than 50 percent.

So, are we doing—should we be doing more mentoring programs? I mean, science and math, if you get a week behind, or if you get a couple days behind, then it's tough catching up.

Has somebody been experimenting with mentoring programs to reach out and individually do a better job of helping these students that might be having a little difficulty?

I mean, to some extent, some colleges and universities have said, well, boy, we are going to be as tough as old rock that first year, and we're going to weed out the guys that really aren't serious about that program, give me your reaction, maybe the three or four of you, to that weeding out effort too, have we gone too far in the weeding out?

Dr. SMATRESK. Well, I would say it's not our job to weed people out, it's our job to connect students to careers, and when a student comes in to our university what we try to do is help them achieve their dreams, not wash them out, and they way we do it is, we offer—there's no one single way to help because students have a whole variety of different deficits, but we offer mentoring and tutoring programs and they are free. Students can take—get help in chemistry, biology, physics, math on a walk-in basis, and that helps some people with mechanical problems, but we found that that doesn't solve the motivational issue.

Motivations keep, if you want to motivate students, then you have to catch their attention, and in order to catch their attention you have to make what you are doing, what you are presenting, relevant, and you do have to ultimately talk about the fact that there's a job somewhere in there. We typically don't do that until junior or senior year. We probably need to start freshman year, first lecture.

Mr. SMITH. Is there a danger—this will be my last question and then I'm going to turn it back to Eddie Bernice—is there a danger of enticing—sort of veering away a little bit from paying well and we'll get more kids in this career, is there a danger of taking too many of the students with a Bachelor's engineering degree instead of somehow doing a better job, or the question is, how can we do a better job of enticing some of these students that finished their Bachelor's to stay in for graduate work in these careers? Whoever wants to react to that. Yes?

Dr. JENKINS. Well, let me go back to the first one.

Mr. SMITH. Okay.

Dr. JENKINS. And then move into the second one, and that has to do with early intervention.

Our setting is very unusual, in that we are rural, and what we have found is that we take 6th grade boys and begin to give them heavy doses of science, and math, and computer experiences, that these young men, first of all, bond as a group, and that regardless of their background, their skills and abilities, that they succeed. We have tracked our first class through high school, and they have done very well.

So, I wanted to mention that in relation to, does it make a difference.

Now, when you take them very early, and you do administer what is needed, and you make them feel that they are going to succeed, they do well.

I think that in response to the second part about are we going to bring too many persons into the sciences——

Mr. SMITH. Are we importing too many foreign students, so that companies don't have to pay the high wages they otherwise might in greater competition with what's here.

Dr. JENKINS. I think that the pay is going to be great regardless, and I can't say—I can say this, that we need to bring more of our own students, especially our minorities and women students, into the workforce, and we can't do that unless we prepare them.

Mr. SMITH. I am going to, Mr. Robbins, we'll wait until the second round, unless you get—and what we do in Congress in Washington, of course, it doesn't matter what question you are asked, you give the answer you want to give.

Congresswoman Johnson.

Ms. JOHNSON. The technique is to use your time and get the most out of it, whether it answers our questions or not.

I am concerned, I guess, with the effectiveness of holding the interest. Every study indicates that girls and boys do very well in math, science until about between the 4th and 6th grades, then they start to drop off. We've tried to do research to try and determine what causes that, and it's been suggested that, perhaps, there are too many variables, and maybe the courses are not lined up in the right fashion, that it maybe should be physics and algebra first, and then the others.

Are there educators here who could comment on that?

Dr. SMATRESK. You've picked a favorite of mine.

Ms. JOHNSON. Okay.

Dr. SMATRESK. Dr. Letterman, a Nobelist at Fermy Lab, has been espousing that physics be taught before biology and chemistry, and that, in fact, the order that we typically present in a university or in high school is reversed, so that what we ought to do is go physics, chemistry, bio, and the reason is, is because biology is a highly integrative subject, and physics is a more fundamental topic.

Logically, I absolutely agree with him, however, I find that without appropriate math basis physics is a pretty tough class. So, I think it's not quite as easy as Dr. Letterman would let us believe, but there's another issue, and in a way we do do this. In 9th grade or in 10th grade we teach integrated physics and chemistry, and if we can get really good at that then we can set people up in a way that will make them appreciate chemistry and physics much more and, perhaps, get more than, what is it, the 24 percent of kids

who take physics nationwide, or at least in our districts, to take physics, because physics is clearly a gateway course into higher level technical careers.

So, one of the things that we are working on at UTA, and in conjunction with our Narvella's teachers, is to do better at teaching IPC, Integrated Physics and Chemistry.

Ms. JOHNSON. You know, for the future we look forward to even today, our prosperity, our competitiveness, our success in the digital world will depend on whether or not we have the young minds to continue to take us to the next level. Do the young people seem to have that grasp? Are the counselors ever saying anything about that in school? Where does that begin? Often, we can't—often parents don't say it, because they often don't know it. At what point do we start to say, if you want to make a real contribution to society, this is where you can be sure that you can do that, because it seems to me that our society has gotten so oriented toward money that we are not even getting researchers anymore. Ninety percent of the researchers in this country were born outside the country, because research doesn't really pay a lot. I mean, you might work 40 years and win a Nobel prize, and you might get $500.00, but it's a very valuable area to be in.

What are you doing to try to balance that? Are we doing that anywhere in the educational K–16?

Dr. ORSAK. Let me address the question and deviate from Washington policy and actually answer it, instead of giving you my pitch.

What we've seen, I want to come back to the money issue that was discussed just a few minutes ago, kids, when they are making decisions about their careers, really can't be motivated by salary, because they only know two salaries, they know what Michael Jordan makes and what somebody makes at McDonald's. They don't know what people make in the middle.

So, if companies started adding $10,000 a year to entice more people to pursue engineering, science or math, it would have very little impact, because kids don't know what that means to them at all, they can't operationalize that.

So, the only way to get kids excited about pursuing these kinds of careers is just simply to, you know, give them the best of what we have. I mean, what we have today in math/science education is still largely what was placed about 30–40 years ago, and we have to accept the fact while there are certain basic fundamentals, that apples do fall down from trees, the way we teach them can't change. We can't evolve science and technology education forward.

And so, I think there's this legacy of staying entrenched in fundamentals and not letting students move forward. We understand, you know, they wear different clothes every two years, you know, they like different things every two years, but we keep pumping the same, you know, 40–50 year old education at them and expecting that it's going to work, and just, if that doesn't work throw more money at it, and we've continued to find that even that doesn't work.

So, the definition of what's fundamentally important for these kids has to evolve with the times. If we want more people in this country to be interested in engineering, technology, math and

science, then we have to do a better job of giving them what we real engineering, technology, math and science education is all about, not what we thought it was about in the '40s, '50s or '60s. I think at that time you'll start to see kids go into it.

One final note on this, we are very fortunate, the Los Angeles Times did a survey last year and asked parents to identify the favorite career choice for their children, and parents, by a ¾ margin chose engineering over all other fields, over law, medicine, even politics.

Parents are pragmatists, they really know what's good for their children. And so, when you have the home front supporting you, and you have the Federal Government interested in doing something, I think we can do something about this now, if we are really ready to move forward on this.

Ms. JOHNSON. I recognize full well that this probably is the fastest change in direction or innovation of anything that we've had in the past. The railroad took a little longer, you know, all that, they weren't even flying that much when I was in college, I rode the train.

But, this did come on extremely rapidly. Most of our teachers were caught unprepared for it, because they hadn't been taught that, and most of the teachers who are really prepared for today's classroom get a job on the way to the classroom paying $60,000 a year. Have we impacted that at all?

Ms. WEST. What we're doing in the Dallas Independent School District is that we have changed the way our staff development looks, and that is based upon the Texas Essential Knowledge and Skills and our Texas Assessment of Knowledge and Skills. I think that was one of the best things that could happen to the State of Texas, because it has given us a very clear guideline as to what children should be taught from K–12.

We know what to teach them, our problem is getting all of our teachers trained to teach our kids, as you have stated, the technological advance has really moved faster than we can prepare our teachers.

So, what we are recommending is that many of our teachers go back for college courses, and we have UTD, UT–Arlington, the University of North Texas, has many of our science students, but again, we need more teachers channeled through that type of training for deep training. They need to understand the content in a conceptual manner, and, you know, to put the mathematics, science, and technology together as an integrated approach to teaching. You cannot teach just science, biology concepts by itself anymore, you have to integrate that with chemistry.

And going back to the question that was raised a few minutes ago, in terms of the sequence of teaching freshmen, high school students, it would be fine with me, as Dr. Smatresk said, to teach the physics first, but the problem with that is that our students don't come with the mathematics background to support physics first. So, what we are doing now is working very closely with our IPC, our Integrated Physics and Chemistry teachers, and that is a prerequisite for chemistry and physics. And, the other driver for that is that we know that our TAAS test that's coming up in 2003 will

be partly integrated physics and chemistry, and biology, so we are going to really work with those teachers.

So, it starts with the teachers, but the education of science, mathematics and technology backs up to elementary. That is where the fire is lit.

Ms. JOHNSON. Thank you very much, and my time has expired. Mr. Chairman.

Mr. SMITH. Well, again, Dr. West, let me ask you a question, has the improvements in test scores at the USCI, USI schools, how have they compared with the non-USI, in terms of test score improvements?

Ms. WEST. Well, in terms of the USI schools, all of our schools are USI for the most part. We have, like I said, 91 percent of our student population is lower socioeconomic groups. We have 50, almost 57 percent of our students are Hispanic.

Mr. SMITH. But, is there some way to compare the success there compared to the non-systemic type of effort in that same kind of school environment, with the same kind of people, as far as comparisons?

Ms. WEST. Well, we have looked at students who come from all quadrants of our city. South Dallas, West Dallas, North Dallas, East Dallas, and in terms of how well they are doing, really, and truly, there's not a lot of difference.

Whenever you give the teachers the appropriate training, they have the materials and equipment that they need, the teachers have tutoring for the kids, there's not a lot of difference.

Mr. SMITH. Do you and Dr. Orsak track students to see if they go into and stay in science and math?

Ms. WEST. Well, what we do is, not so much as tracking, what we do is that, at the high school level, you know, they go from middle to high school, and as somebody said, often it's not very easy for the students to determine what courses they want to take, but based upon their TAAS scores counselors and teachers recommend that they go into the pre-AP and AP courses.

And, I can tell you that our numbers have increased annually.

Dr. ORSAK. And, I'll answer that as well.

We do very specific tracking on all of our students, except—and just to give you my observation, it's hard to track a child coming out of high school going off into college, there's just a huge chasm there, and almost all the data is lost. So, to really build a longitudinal study to see how well K–12 initiatives are doing, are translating, in terms of higher ed, I think we really have to figure out a way to bridge that gap and find a way to really, essentially, put homing devices on these children from kindergarten all the way through graduate school. Otherwise, we are going to lose them, particularly, from the time they leave home and head off to college.

And, I wish that—I don't think under this legislation that that would be a solution to that, but that would be something that I would strongly encourage the Congress to try to identify a way for us to stay on top of these children every step of the way.

Dr. SMATRESK. You lose them after college, too, and it's a tremendous data keeping nightmare for all of us, as soon as they leave they disperse.

Mr. SMITH. But still, to the extent of really gauging the success of any program, it seems like we need to at least get your advice, get everybody's advice, to try to do a little more tracking to see what's really working in the long run.

Dr. Smatresk, how can we do—in terms of letting people know career potentials in high school, or maybe letting their parents know these career potentials, you know, from nanotechnology just taking off at the University of Texas in Dallas, to other careers that have just such tremendous potential, not only as far as income, but to help people and help the United States keep our position economically, how do we do a better job?

Dr. SMATRESK. Well, I mean, it's everybody's job, we have to do it in higher ed for sure, and it's done, believe or not, we don't a lot until it's late. But, the way we're suggesting doing it, is working again with teachers directly by helping them to understand what's going on in very modern science. And, I mean, we are working with them on areas like robotics, and nanofab, and all kinds of issues that are highly contemporary, genomics, and so forth.

If they understand the careers and the excitement, they can bring that back to the classroom. If they haven't heard about it, they can't inject it at all.

We also need to work with the counselors better.

Mr. SMITH. I'm going to wind up the hearing, unless you, Representative, have other questions——

Ms. JOHNSON. I don't, but——

Mr. SMITH.—by letting everybody take 30 seconds to a minute to give us any additional information that you think we should be taking back to Congress, and we'll go the other way.

Mr. Robbins, starting with you, and working down.

Mr. ROBBINS. Thank you, Mr. Chairman.

We would encourage as much interacting educational experiences for students as possible. We've had good experiences in the elementary grades, middle school, and high school, in involving students in activities that would excite their natural curiosity, to make them want to pursue math, science and technical studies, and anything that could be done by Congress to expand this kind of activity as rapidly as possible we feel would have big dividends.

Mr. SMITH. Ms. Sterry?

Ms. STERRY. I think the key message I'd like to leave with you today is that we believe a comprehensive approach is mandatory, one that would track students early in the K–12 years in following an engineering curriculum, and supporting a higher level of education, and also to engage in outreach to bring promising students into the industry.

Mr. SMITH. Good.

Mr. Penermon.

Mr. PENERMON. Certainly, all the other things are necessary to stay in place, the one thing that could give business and industry a way to stay engaged with the education process is utilizing the web to help those students who are in the primary schools, and the teachers and others, understand what our jobs are in the technology environment, actions on the legislative part to help make that something that the counselors would really look at on a sustained basis would be a big help, I believe, to helping everyone un-

derstand what the technology careers are, and then how do you prepare for those in terms of what education is necessary.

Mr. SMITH. I am going to, Dr. Jenkins, before you make a comment, I am going to excuse myself, I actually have a science breakfast tomorrow morning in Washington at 7:00 a.m., and my plane is 5:20, and staff says I should go now if I'm going to catch a 5:20.

So, everybody, thank you very much, and with that I turn the gavel over to adjourn the meeting and for final comments of these folks and you.

Thank you very much.

Ms. JOHNSON. Thank you, you can take your gavel with you if you want to, I'll use this——

Mr. SMITH. You are not going to use it?

Ms. JOHNSON. Go ahead, Dr. Jenkins.

Dr. JENKINS. My final comment would be, given the track record of UNCF institutions, as well as other HBCUs, I'd like to see Congress join the partnership with us and making sure that there is a greater equity in funding, not only funding for program purposes, but facilities and infrastructure kinds of necessities.

We think that at this point, in response to the Chair's question too, about how far along have we come, no, your response—your comment, I think that right now there is a great need for the integration of technology into the classroom. There's also the great need to put more of our science faculty with our education faculty, so there not only are more funds available for the programmatic, but as well, as I said earlier, the facilities and infrastructure kinds of things.

Ms. JOHNSON. Dr. Smatresk.

Dr. SMATRESK. Well, I only have a couple simple things to say. Faculty in higher education and science and math have to remember that we should not always stay in the ivory tower, and that we are the people who try to—we should be connecting K–12 with industry, and taking that role seriously.

But, I also want to put in a plug for the teachers. While every teacher I know wants to upgrade their abilities and their content knowledge and do a better job, but, you know what, school is expensive, and on a teacher's pay check it's tough. And so, I want to say, unequivocally, any funds that you can give that support teachers to go to school, to improve their knowledge, their content knowledge, is money really well spent.

Dr. ORSAK. I heartily agree, and I'd like to just conclude by saying that I believe very strongly that teaching fundamentals is critical for the future of America, but we need to recognize that fundamentals do change. And, if we're serious about addressing math, science, engineering and technology, then engineering and technology have to be part of the fundamental suite that we offer kids today, and until we do that we are going to—we'll be back here five or ten years from now addressing these same concerns.

Ms. WEST. I think we need to spend more time educating our students here in America, and we need to spend time educating our teachers. So, any funding that is available to help our teachers prepare our students, I think that's one very important component.

I had a call just today from a teacher who attends the MAIS, and I'm telling you, he is so excited, and that is where we have to start.

Thank you.

Ms. JOHNSON. Thank you very much.

My final statement is just this, right here in Dallas the number one childcare program in the country is here. The number one Head Start movement in the country is here, and one of the best high school experiences in the country is also here. They are all expensive. They are all supplemented by the private industry, and I cannot compliment Texas Instruments enough, they have really put in a lot of money in the community.

Kids in the Head Start program, with Public Housing, and with a lot of single—mostly single parent households, at Frazier Courts, they are testing better than those kids at Highland Park, it's because they have teachers that show interest and good form. That is rare in our classrooms, most especially where there are these children.

And, until—I don't believe in throwing money at anything, I'm a hawk when it comes to accountability, just ask my staff, but I do think that you get a return on your investment, and I believe that you, the public, needs to demand more quality in education and then take on the responsibility, whatever it takes to get us there. We've got to get there. There's no question about it. Our future depends on it, whether or not Lockheed Martin can stay open or stay competitive depends on what kind of students graduate. The same thing with TI.

And, I would say to the students that are here, it is not magic that causes things to happen, it is a person or persons. The chip that's in everything, even in my car key opener, came out from TI here with one man, Dr. Keeling, made the worldwide company, and everything you pick up is by chip.

When I was coming along, my mother taught me how to tell time by the long hand and the short hand, whoever heard of that recently. My six-year-old grandchild told me he had to have another Play Boy, whatever these little things are—he's got the Play Station——

Ms. WEST. Game Boy.

Ms. JOHNSON.—Game Boy, and when he started school I had to get him a TI 83 or something like that to use. Times have changed. Education and preparation for teachers must change with it, and it's not cheap, but it's worth the investment. Demand more for your tax dollars.

Thank you.

[Whereupon, at 3:55 p.m., the Subcommittee was adjourned.]

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